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SEAMEO VOCTECH Journal

The SEAMEO VOCTECH Journal, the official journal of SEAMEO VOCTECH Regional Centre for Vocational and Technical Education and Training, is published twice a year in June and December.

It is a medium of sharing and disseminating information and experiences in vocational and technical education and training (VTET) to all. We believe that much can be gained when there is a focal point where information is sought and utilised to enhance vocational and technical education and training, particularly in Southeast Asia.

The editorial objectives of the SEAMEO VOCTECH Journal are as follows:

- To provide all readers involved in VTET with current practices, ideas, news and research on major issues in the area.
- To inform readers on major developments in VTET to enable sharing of experiences.

The following areas are covered in the journal:

- Innovations in vocational and technical teaching and curriculum development
- Human resource development in VTET
- Technological advancements and practices in VTET
- Researches in VTET.

Readers and contributors wishing to submit manuscript for publication should refer to the guidelines and details on the inside back cover.

SEAMEO VOCTECH would like to emphasize that all opinions expressed in the published articles are those of the authors of the respective articles and do not necessarily reflect the views of SEAMEO VOCTECH or any member government of the Southeast Asian Ministers of Education Organisation (SEAMEO).

DIRECTOR’S MESSAGE

The SEAMEO VOCTECH Journal, with the objectives of stimulating research and development at the same time facilitating dissemination of research findings to the region and beyond has published its edition, December 2005 Issue.

In line with the theme of “Vocational and Technical Education and Training in the Era of Globalisation,” this Journal has included a number of contributors that have integrated such a view in their articles, while others applied the theme directly in their discussions. The articles, nonetheless, identifying the authors’ varied expertise in vocational and technical education and training are views that reflect their wide range of knowledge and expertise.

The Journal, comprising articles contributed will hopefully generate interest among readers - the educators in Southeast Asian region and beyond. The SEAMEO VOCTECH Regional Centre, through its Research Division, will be awaiting any information on research-related attempts for further collaboration, etc. Also, as the theme signifies, SEAMEO countries, in fostering team-spirit and cooperation, must gear proactive and forward-looking efforts in today’s era of globalization.

To all contributors of articles to this SEAMEO VOCTECH Journal-December 2005, I sincerely thank you for sharing to us and all readers your intellectual and professional VTET knowledge and perspectives. I wish to thank all members of the Editorial Board and Reviewers and to all staff concerned.



MOHAMAD BIN ABU BAKAR

“Together We Excel”

EDITORIAL

Dear Readers of SEAMEO VECTECH Journal,

After awhile, finally we are back on track again to carry on the SEAMEO VECTECH Journal publication with the December 2005 edition. We are pleased to publish this edition after almost one year of absence due to the vacuum of positions in the Editorial Board. As planned, the journal will still be published twice a year, June and December 2006 editions.

This edition covers various topics under the broad theme of Vocational and Technical Education and Training (VTET) and Globalization. The first article by Kenneth C. Gray and Sang Hoon Bae addresses the issue of skills shortages partly due to educational policies and personal choices that put much emphasis on higher education over vocational and technical colleges. Various data show that labor markets need more technical workers with diploma or certificate from technical colleges than those from 4-year universities. This fact contradicts the present international phenomena that more countries are focusing more on higher education, 4-year degree or above, than on vocational and technical education. Consequently, most countries are having over educated workforces but lacking of necessary skills to enter labor market. This article offers alternatives to face with the dilemma.

The second article by Susan Dawe explains the process of systematic reviews of research in vocational and technical education and training for decision making tool for policy and practice. Using Australian example from the National Centre for Vocational Education Research Ltd. (NCVER), the author describes step-by-step of the whole process of research reviews.

The third article is the report on the impact of industry exposure or industrial attachment on the skills development of technical areas. Using the Philippines example the author, R. Lyndon H. Roble, focused the study on impact of industry exposure on Machine Shop skills development. The findings support the idea of incorporating industry exposure into vocational and technical areas. The impact of industry exposure is not only on improving the participant's knowledge and skills but attitudes and habits as well.

The fourth article is a cross-national analysis of when and how formal vocational and technical education (VTE) is offered. Using examples of countries representing Southeast Asia, Europe, and the Americas, the author, Paryono, described the salient reasons for offering VTE at certain grade levels and for administering the programmes whether they are separated from or combined with the general education. The author also explained the pros and cons of the selection.

The fifth article discusses a new learning technology called Multi-Channel Communication (MCC) that utilizes three types of human intelligence: Figural, Symbolic, and Semantic. Based on the research conducted at Motorola manufacturing facilities in Southeast Asia, the author, James R. Frasier, suggested that the traditional way of presenting instructional materials in Semantic format, commonly used in Australia, Europe, and North America may be inappropriate for Southeast Asian populations because such materials are not in line with the Symbolic and Figural learning strengths of Southeast Asian Learners.

The sixth article written by Alison Anlezark, Tom Karmel, Koon Ong attempts to measure the success of Vocational Education and Training in Australia based on student retention rate and employment or further study after graduation. The findings show that the participation in VET programmes have not led to a significant increase in retention. There was a poor connection between the types of VET programmes studied at school and the requirements of work or further study.

The last article written by Ogbonnaya Chukwu describes two models of curriculum reform, Centre-Periphery Model and Research, Development and Diffusion (R, DKD) model. The DACUM process, currently used in Brunei Darussalam, is also discussed. The paper also examines the relevance and the effectiveness of the models and processes in Brunei context followed with some suggestions

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SKILLS SHORTAGES, OVER-EDUCATION, AND YOUTH: THE INTERNATIONAL DILEMMA

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Abstract

Worldwide, a paradox is hindering economic growth. Many nations have severe shortages of technicians concurrent with high rates of over-education among four-year college graduates. The fundamental causes are over-investments in university level education that result from labor market/social misconceptions by policy makers, youth, and parents regarding the global high-skills/high-wage labor market. Eight recommendations are made to solve this dilemma. All speak to the importance of technical vocational education (TVE) in creating economic growth and individual opportunity.

Keywords: Skills shortages, vocational and technical education, economic growth, labor market, educational dilemma, educational policies

Background

One goal of all nations is to pursue policy that continuously improves the wealth and standards of living of its population. For this reason, economic growth is a priority worldwide. Modern economic theory attributes economic growth to the interaction of four types of economic capital: natural resources, technology, human capital – skilled workers – and social capital – social standards that are conducive to economic growth. Of these four, human and social capitals now generally are considered the most important resources in the new global economy (Thurow, 1996, 2003). The reason is that natural resources and technology now move around the world – to a place where the prerequisite workforce skills can be purchased for the lowest relative wage rates. This reality is not lost even on oil-rich nations as they look to the future, and in fact there are cases in developing countries where rising world prices for oil and other minerals have led to a decline, not increase, in Gross National Product (GNP). Thus, a nation’s workforce will determine the degree to which it participates in global economic growth in the long run. Importantly, a nation’s workforce – its citizens – are “relatively” less mobile than other types of capital, more likely to stay in the country, and thus, human capital investments – or, human resource development – is becoming the best public policy for future growth of nations (McLean, Osman-Gani, & Cho, 2004; Paprock, 2006).

The High-Skill/High-Wage Strategy

Human capital can be divided into two types: low-skill/low-wage and high-skill/high-wage. Countries with low relative wage rates can initially capitalize on

this human capital-based advantage by producing goods and services that require low wage rates to be competitive in the global market. This strategy is effective only as long as wage rates stay low. Prosperity, it has been shown, invariably leads to higher wage rates however. Achieving higher wage rates is an important national goal because this is a prerequisite to sustained economic growth. Thus, developed and developing countries, faced with the certainty of higher wage rates now or in the future, can compete in the long run only by being more productive than low wage rate countries and/or by producing value-added goods and services that require more highly skilled workers. This is termed the high skills/high wage economic growth strategy and is the ultimate goal of all nations.

Consider a hypothetical situation where two countries manufacture the same product that sells on the world market for one United States dollar (USD). Country A has wage rates of 20 USD per hour, while country B has a wage rate of one USD per hour. How can country A hope to compete with country B? By being more productive. Assuming all other costs are equal, country A can be competitive if it can produce 20 times as many units as country B in the same given time. To do so, however, requires a much more skilled and efficient workforce. The key, therefore, to a world-class standard of living is a world-class high-skill/high-wage workforce. In conclusion, human capital investments that produce skilled technical workers, such as Technical Vocational Education (TVE), are essential to sustained growth and prosperity.

Dissecting the High-Skills Workforce

While there is international recognition of the importance of a world-class workforce to economic growth, the skills/credentials composition of this workforce is generally misunderstood. The common misconception is that the majority of workers in global high technology industries will need a four-year college degree. In the US, for example, the growth in information technology (IT) led to the conventional wisdom that most jobs in this field would require an engineering degree in computer science. This conclusion is incorrect.

Contrary to this conventional wisdom, individuals trained at professional or university level represent the smallest segment of the high technology labor force. Figure 1 below shows the results of a study of the US high technology labor market by the American Association of Training and Development (ASTD). It is notable that professionals are in fact the smallest segment of the technical workforce (19%). The largest group is blue-collar technical workers with skills associated with vocational education (57%).

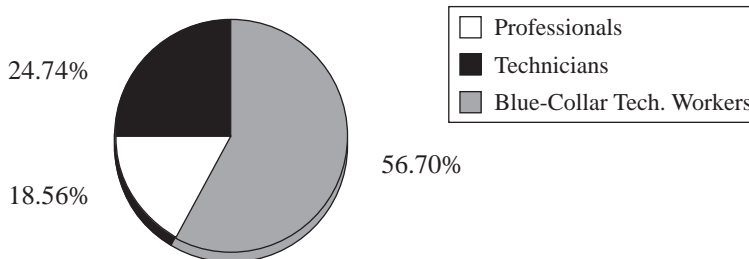


Figure 1. The Technical Workforce.

Source: From "Workplace Basics" by Carnevale, et al. (1990).

Of particular importance to this discussion is the group called technicians. In the U.S., they are often referred to as “gold-collar workers” because of the high salaries they earn. Four observations about this group are important. First, they outnumber university level professional workers. Second, they are the fastest growing segment of high technology workers. Third, they are typically prepared at the pre-baccalaureate technical college level. Finally, and most importantly, firms will recruit internationally for engineers or transfer them in from abroad. But, they expect/prefer to find technicians in the local labor market and locate/expand where they can.

In the U.S., for example, it is generally recognized that the existence of a significant mass of workers, technically trained at the pre-baccalaureate level, is the key factor in a firm’s decisions to expand or relocate. The importance of this group of workers cannot be overstated. In one U.S. case, a firm needed only 15 technicians to begin a major plant expansion. It could not find these technicians and did not expand. The direct and indirect economic effect was a loss of 19 million dollars to the economy of the region or one and a quarter million dollars per technician (Wall & Passmore, 1997). Thus, among economic development experts in the US it is generally agreed that:

A region that does not have a growing percentage of its non-professional workforce trained beyond the high school level will have increasing difficulty in supporting the competitiveness of high value business. (Pennsylvania Economic League, 1996, p. i)

A region can be an urban area, a state, or a nation. Ireland, for example, experienced a GDP growth of 90% in the decade of the 90s. It increased employment by over 40% (The Economist, 2000). It met job growth initially from a large pool of unemployed or under-employed and by attracting expatriates back to the country. Now it finds its growth stymied by technical labor shortages. This situation exists not just in Ireland, but internationally, and hints at a quiet global dilemma.

The Quiet Dilemma

Virtually all nations seeking to compete in the global market for high skills/high wage goods and services face a common “quiet” dilemma. The dilemma is of two parts: skilled labor shortages and over-education of many university graduates.

International shortages of technicians

The first part of the “quiet” dilemma is actually not “quiet” at all. It is common knowledge that there are severe labor shortages among nations seeking to compete on a high skills/high wage basis in the global economy. Firms are not finding it difficult to recruit university-trained engineers or scientists; in fact there is, in general, a worldwide surplus. Instead, the shortage is for those with training typically associated with pre-baccalaureate TVE. Specifically, the credentials in demand are for associate degrees or certifications in technical fields. In the case of US labor market, for example, the occupational employment projections to 2010 done by US Bureau of Labor Statistics (BLS) shows that computer support-related

occupations typically requiring two-year college education are projected to have 490,000 new jobs over the 2000-2010 period, while computer software engineers normally requiring four-year university education are expected to add 380,000 new jobs during the same period. Moreover, in terms of 2000 median annual earnings, the report suggests that the quartile rank of the computer support occupations belong to “high” among the following four categories: very high (\$39,700 and over), high (\$25,760 to \$39,660), low (\$18,500 to \$25,760), and very low (up to \$18,490) (Hecker, 2001).

No developed or developing country seems to be immune from this problem. A good example is South Korea, which aggressively invested in developing a world-class workforce in its drive to become an advanced economy, now has a highly, post-college educated workforce and high levels of technologies which led to economic success during the past few decades, and manifested the “importance of creating man-made sources of competitive advantage” (Thurow, 2003, p. 291). It, however, is now faced with a growing shortage of technicians typically requiring two-year college level education – particularly, the problem is found in small and medium-sized businesses which are integral segments of the Korean economy (Korean Prime Minister’s Office, 2004). Another example is China of which economic growth rate is reported to have slowed due to labor shortages of technicians (People, 2002).

Over-education

The second part of the dilemma is the quiet part. Few people want to talk about the worldwide growing numbers of underemployed four-year college graduates. It is somewhat of an embarrassment to public policy makers, government officials, universities, and university graduates. It is an uneasy topic. It hints of educational and economic development policy gone wrong, of public investment wasted, and of un-kept promises made to youth.

It is difficult to understand why skill shortages exist. Following the “education as salvation” argument (Livingston, 1998, p. 6), nations have sought to increase educational levels in general and university graduates in particular. This growth is illustrated in Table 1 below for selected Organization for Economic Cooperation and Development (OECD) countries. Similar growth occurs in Asia. Korea, for example, despite the declining student population, the number of college-educated people has increased by 2.6 times over the past two decades – from 192,511 in 1985 to 493,944 in 2004 (Korean Education Development Institute [KEDI], 2004). China has also pursued a policy of increasing college graduates since 1999: college graduates increased by 670,000 from 2002 to 2003 alone (People’s Daily, 2004).

Table 1. *College Enrollment as a Percent of Age Cohort: 1950-1993 (%)*

Country	1950	1993
Sweden	4	35
UK	4	37
France	4	50
US	6	81

Note: From “World Development Report: The state in a changing world,” by World Bank (1997).

In the last half of the twentieth century, postsecondary enrollment has increased dramatically around the world. In the US, for example, college is now the norm rather than the exception for youth. Yet it would seem that there is a surplus of individuals with degrees but at the same time a shortage of university graduates with skills. The evidence for this lies in the increasing rates of systemic over-education.

Over-education is defined in this paper as the gap between an individual's performance potential as indicated by educational credentials and the skill set actually used or required in their job. While the actual percentage of over-educated university graduates varies according to method of calculation, all methods indicate that the rate has doubled in the North American labor force (Livingston, 1998). Writing in the *Monthly Labor Review*, Pryor and Schaffer (1997) estimated the U.S. rate of college graduates in high school level jobs at 30%. Those most likely to be over-educated are young workers with higher education qualifications (Livingston, 1998). In a U.S. study, 43% of recent four-year college graduates self-reported that they held jobs that did not require advanced degrees (McCormick & Knepper, 1996). Over-education among those with degrees in technical areas such as engineering and computer science was 20% or less, while the rate for those with degrees in the social sciences was 50% or more.

Similar situations exist throughout the world. In Korea, for example, the employment rate for four-year college graduates in 2003 was 56.7%. But, for vocational high school graduates, it was 92% (KEDI, 2004). In China, the dramatic growth of college graduates has left many disappointed and unemployed (People, 2002).

Over-education has spawned a second development that is indicative of the quiet dilemma, namely reverse transfers. The term reverse transfer refers to individuals who enroll in associate degree or certificate programs after they have completed or dropped out of four-year or graduate school degree programs. Corresponding to the growth of over-education in the U.S., reverse transfers are the fastest growing group of students enrolled in pre-baccalaureate technical education. In the U.S., it is estimated that 30% of pre-baccalaureate technical education students are reverse transfers. In some technical programs, reverse transfers are the majority. The motive of reverse transfers is to learn skills that they hope will make them competitive for high skills/high wage employment. Reverse transfers tend to be, for example, the least competitive of university graduates, graduating with low grade point averages and/or with majors in the social sciences (US Department of Education, 1995).

This then is the quiet international dilemma. First, there are worldwide shortages of technicians. Second, the number of university graduates has never been higher. Third, many who graduate from universities end up over-educated/underemployed; many of whom become reverse transfers in order to learn technical skills that lead to high-wage employment. It is paradoxical that while some of a nation's most academically talented go underemployed, firms often cannot expand for lack of technicians. In terms of stimulating economic growth and promoting individual economic opportunity, a human capital development policy that emphasizes university education alone has proven to be a failure. What is needed is a greater emphasis on secondary and postsecondary TVE.

In *The Competitive Advantage of Nations*, Michael Porter, a leading scholar on competitive strategy and economic development of nations, made clear this point:

Contrary to conventional wisdom, simply having a general workforce that is high school or even college educated represents no competitive advantage in modern international competition. To support competitive advantage, a factor must be highly specialized to an industry's particular needs (Porter, 1990, p.78)

Understanding the Quiet Dilemma

The root cause of the quiet dilemma is poor decisions by those charged with economic/workforce development as well as students and their parents. These decisions can be traced to misconceptions regarding the labor market and the conclusion that a four-year degree is the "only way to win."

Labor Market Misconceptions

One cause of the quiet dilemma is widespread misconceptions about the new labor market. Here are three examples.

1. In the future most careers or at least high-wage technical careers will require a university education. Thus, economic and human capital development policy should emphasize university education.

Labor market projections are consistent internationally; the majority of total employment in the future still will not require a university education. In the U.S., for example, Department of Labor projects that only 26% of all occupations through 2014 will require a four-year college or graduate school degree; unfortunately, the reality is that low skill/low wage jobs will still outnumber high skill/high wage jobs in the future. (Hecker, 2005). The sobering fact is that even in the world's most developed economy, 40% of all jobs are low skilled occupations that can be learned in only two weeks or less of on-the-job training (Silvestri, 1997). Although it is predicted that the majority of jobs that are newly added to the labor market may well require a university education, the largest number of these jobs will require secondary or post-secondary pre-baccalaureate TVE not university or graduate school education.

2. The economy will create enough university jobs to accommodate the increased numbers of graduates.

This misconception appears to be universal. It is the belief, mixed with a great deal of hope, that the answer to the widening gaps in the distribution of income is to urge as many as possible to get a university degree. The assumption is that the economy will respond with more university level employment. It is implied that labor market demand for university graduates is labor supply driven. While there are cases of labor supply driving labor demand, such as health care, they are unique. Generally, labor market demand is a response to the demand for goods and services. In this context, over-supplied four-year college graduates would cause

various labor market problems. As seen earlier, even in the U.S. economy, one of the most advanced in economies in the world, only 15% of the total job openings are projected to be filled by four-year college degree holders over the 2004-2014 period (Hecker, 2005). From this statistics, one may speculate that any nation that increases the numbers of university graduates much beyond 20% of the labor force will experience over-education that, in turn, can lead to brain drain as the underemployed seek employment abroad, or even worse, social unrest among the highly educated but unemployed.

3. University graduates will displace those with less education in jobs that do not require a four-year college degree.

This myth is at the heart of youths' and parents' fears that fuel the mania for a four-year college degree and neglect of TVE. It is the worry that an increase in the number of four-year degree-holders will result in a situation where those without a baccalaureate degree will not be able to compete for the better jobs that do not require a college education. However, there is little evidence to support this fear. In a 2005 national survey of U.S. manufacturing employers (National Association of Manufacturers [NAM]), 80% of respondents indicated that they would have shortages of skilled production workers over the next three years, while only 35% of respondents anticipated shortages of scientists and engineers (NAM, 2005). In the case of Korea, despite the increasing college graduates, 90% of the TVE high school completers, equipped with technical skills, have continued to be employed during the past decade (KEDI, 2005).

There are cases of four-year degree holders displacing high school graduates but mostly in low-skill/low-wage work in retailing, service and recreation. In the competition for technical high-skill/high-wage occupations, however, they do not displace TVE graduates who have the required specific occupational skills. To be specific, an individual with a university degree in Art but lacks computer graphic design (CGD) skills will not displace a person with an associate degree in CDG. In fact, it is highly unlikely the college graduate will be employable in the graphics fields until/unless they learn these skills. This is a critical point. Because of the importance of specific technical skills, a person with more formal education will not necessarily displace an individual with less education but who has the requisite technical skills. A study undertaken on the Korean labor market supports this critical point (Bae & Song, 2006).

The One Way to Win Paradigm

A second factor creating the quiet dilemma is the "one way to win" paradigm (Gray & Herr, 2006). It is commonly believed that the only "way to win" economically and socially is to (a) get a university degree, (b) in order to earn high wages, (c) in the professional ranks. In the U.S., for example, a national poll of students in their final year of high school found that 85% hope to get a four-year college degree. Surveys of entering college freshmen in turn revealed that the number one reason given for enrolling is to get a high paying job. When asked what kind of job they aspire to have by age thirty, 68% of young women and 49% of young men all said they hope to get a job in the professions (Gray, 2000). And while the percentages

of youth that actually attempt to pursue this goal may be the highest in the U.S., the goal itself is universal. Thus, experience in the U.S. suggests that while lacking any contrary information that there are “other ways to win,” the majority of youth will reject TVE in favor of a university education. In fact, the ratio between the number of associate degree conferred and that of bachelor’s degree conferred in the US colleges is projected to increase – from 1: 1.98 in 2003 to 1: 2.16 through 2013 (The Chronicle of Higher Education, 2005). This in turn creates the quiet dilemma: shortages of technicians and over-education. The question remaining is what can be done?

Solving the Quiet Dilemma

The quiet dilemma is an economic conundrum. Nations that can solve or prevent the quiet dilemma will have a strategic advantage over those who can not. The answer to the quiet dilemma is increased emphasis/enrolments in secondary and postsecondary pre-baccalaureate TVE. What follows are eight recommendations for increasing the importance of TVE.

Promote an Understanding that There Are “Other Ways to Win”

Solving the “quiet dilemma” requires first an understanding that, from both an economic development point of view as well as an individual career opportunity perspective, there are “other ways to win.” The “other way” is technician level employment.

The economic importance of having a growing technician class of workers was discussed earlier. It is this class of workers that is the keystone of economic growth. In the U.S. for example, many firms that went abroad in the 80’s are now returning. Why? It is because the nature of their business has increasingly sophisticated. The low wages that attracted them abroad in the first place cannot make up for the fact that they cannot find employees with sufficient levels of technical skills. It is important to remember that the market for university trained engineers is global but firms look locally for technicians and locate around the world to where they can find them, bringing their engineers along. In particular, regarding the role of postsecondary pre-baccalaureate TVE, Zinger and Lawrenz (2004) pointed out that TVE programs offered at U.S. community colleges are very effective in assessing local labor market needs and providing technician training for the economic development of the community “because of their proximity, access, flexibility, cost effectiveness, and experience working with industry (p. 88).”

Likewise, from an individual’s career opportunity point of view, TVE offers the best return on their investment of time and money. By way of illustration, Table 2 below lists the six main occupational groups in the U.S. economy ranked by annual earnings and net opportunity (demand minus supply). Managerial/Professional has the highest annual earning and virtually all occupations require a university or the graduate degree. But in terms of net opportunity it is last. In fact it is negative because in the U.S. there are twice as many people prepared annually than managerial/professional vacancies.

Nonetheless, it is notable that the second highest paying occupational

group in the U.S economy is craft/precision manufacturing, and specialized repair. Most of these occupations in this group can be taught in TVE high school and pre-baccalaureate programs. In terms of net opportunity, it is third. In the U.S., the annual earnings of workers in this group exceed that of university graduates except those who find managerial/professional employment. It should also be noted that third in earnings is the group called ‘technical support’. This group is first in terms of net opportunities. Many new IT non-professional technical occupations fall into this category. Clearly, there are other ways to win – specifically, high skill/high wage occupations that do not require a four-year college degree, but instead will require high school, or post-secondary pre-baccalaureate TVE. (see Appendix one for a representative list of these occupations.)

Table 2. *Occupational Groups Ranked by Earnings & Net Opportunities (projected through 2006)*

Group	Annual Earning	Net opportunities (Demand-Supply)
Managerial/Professional	1	6
Craft/Precision manufacturing/Specialized Repair	2	3
Technical Support	3	1
Service	4	4
Operative/Labor	5	2
Farming/Fishing	6	5

Note: From “*Getting Real: Helping Teens Find their Future,*” by Gray (2000).

In terms of employment opportunities for TVE program completers, the same was found in the Korean labor market even though it is the case for small and midsized businesses (SMBs). As shown in Table 3, the 2003 Small and Medium Business Employment Survey points out that there is the greatest and growing labor shortage for the group of technicians and operators that typically require two-year college and high school level vocational education, respectively. Moreover, the manpower shortage in SMBs, according to the Korean Ministry of Labor (2004), accounts for 93.6% of the total labor shortage.

Table 3. *Job Shortage for Each Education Category in Small and Medium-Sized Businesses*

Management /Clerical	Production			Service	Sales	Total	
	Professional	Technician	Operators Labor				
11,018	4,896	13,398	52,206	51,495	624	5,310	138,947

Note: “Professional,” “Technician,” and “Operators” are job categories that typically require a four-year degree or more, a two-year degree, and the high school level vocational training, respectively. From “Special report on youth unemployment,” by Korean Prime Minister’s Office (2003).

Explain the Sources of Labor Market Advantage

Another misunderstanding fueling the “one way to win” philosophy is about what credentials are necessary to successfully seek high-skills/high-wage

employment. In general, there is widespread confusion regarding the relative importance of work ethics, formal education, and occupational skills. Employers frequently indicate all they need is someone with a good work ethic. Academics argue that educational credentials are what counts; employers will provide the specific training necessary. However, in reality what counts in seeking high skill/high wage technical employment is occupational skills. Figure 2 below illustrates this point.

There are three types or levels of employability skills: work ethics, academic skills, and specific occupational skills. Those who have these skills have “advantage” over others in competing for employment. Level I – work ethics and related behaviors – are essential for all types of employment, but are the only skills needed for low-skill/low-wage jobs that require only minimum on-the-job training. When employers indicate that all they need are applicants with a good work ethic, it is an indicator that they are hiring low-skill/low-wage workers.



Figure 2. Source of individual labor market advantage.

Source: From “Workforce Education: The Basics,” by Gray & Herr (1998).

Level II academic skills – reading, math, communications, and science – become prerequisites as the nature of work progresses toward high-skill/high-wage employment. They are important, however, not because they are used daily on the job. In reality, the academic skill set used in any occupation is specific and small (Pucel, 1995). Math reasoning ability is the only academic skill that predicts productivity on the job. But academic skills are still important because they are necessary for learning what really counts in the modern high technology employment, namely Level III specific occupational skills.

Labor market advantage and employability for high-skill/high-wage technical occupations requires Level III certified occupational skills or a set of experiences that demonstrates these skills. In national studies of manufacturers in the U.S., occupational skills were listed first in importance in hiring decisions (Bishop, 1995, NAM, 2005). This is true for two reasons. First, in many industries the skill-set required on the job is very specific and changes so rapidly that firms require individuals with the needed skill-set immediately. While employers may provide firm specific training, they need trainees with prior advanced technical skills as a prerequisite. As an indication of the rising importance of skill and the decreasing

importance of general higher education, IT firms in the U.S. are not as concerned about what degrees a person has as they are about what IT skills certificates they hold. It is now relatively common for high school graduates with advanced IT skills to go directly to work in IT skipping college or going part time.

The second reason skills are of primary importance for individuals seeking high-skills/high-wage employment is that in some industries there is a surplus of applicants, particularly for soft-skill managerial trainee type positions. Because applicants outnumber openings by almost two to one, employers can be very selective. The criterion they use is demonstrated occupational skill as documented by actual work experience or internships.

Monitor Human Resource Investments and Graduates

Solving the quiet dilemma suggests a closer look at human resource investments at the government level. As argued earlier, in most cases, there are excess investments in university education and insufficient investments in TVE. One useful but simple monitoring method is to calculate the ratio of degrees awarded at the university level compared to the number awarded at the one and two year pre-baccalaureate TVE level. In a pure workforce development higher education system, the ratio, as dictated by the labor market, should be about 2 university degrees to 3 TVE pre-baccalaureate degrees. In the U.S., the ratio of university degrees awarded to associate degrees is almost the opposite, namely 2 to 1, and the majority of associate degrees awarded are in general education, not TVE. The true relationship is probably closer to 3:1, thus the quiet dilemma in the U.S.

Human capital investments in pre-baccalaureate TVE will have positive national return on investment, only if those trained stay in the country. If and when firms cannot find technicians in the local labor market or relocate to where they can find them, then they have no choice but to try to recruit technicians away from other firms in other countries. Therefore, the international shortage of technicians can be predicted to lead to a new economic development challenge, namely preventing technician brain drain. For this reason, some economists suggest that countries should develop a new economic indicator that monitors their balance of trade in skilled technicians (Perkins & Perkins, 1999). Economic success in the future will depend both on developing a technician class of workers and keeping them in the country.

Provide Career Guidance to Youth

Ultimately the quiet dilemma will be resolved when more youths decided to become technicians. The decision process, of course, differs greatly around the world. On the one extreme is the US, which allows any students to try any type of higher education independent of their academic ability. More common are systems that limit the number of students admitted to universities, and therefore, TVE becomes a second choice by default. In either case, however, TVE is successful only when those who enroll do so for well-thought-out reasons. Return on investment (ROI) studies of TVE consistently found positive returns but only when individuals pursue careers in occupations related to their training. Very often when students drop out of TVE programs or do not pursue a related career, when they graduate

it is because they decide they did not like the occupation after all. The chances of preventing this from happening are greatly improved when the decision is well thought out in the first place. It is worth noting, for example, that the German system of TVE places a premium on career counseling and awareness. German firms understand that its investment/support of the apprenticeship system pays off only when students pursue careers in their apprenticeship field and that good career guidance helps to ensure this happens.

For these reasons, it is important that TVE educators become vocal advocates for career development activities in the primary and secondary education systems in their country. TVE at the high school level can play important roles in these efforts. In particular, students need a chance to validate tentative career choices prior to making a decision regarding pursuing a TVE program of study. High School TVE can help by running exploratory programs as part of their curriculum offerings.

Increasing TVE Incentives for Students

Even with adequate career development activities for youth, universal cultural preferences for a university education – “education fever (Seth, 2003) and “diploma disease (Dore, 1976)” – are still very powerful. For this reason, incentives for students to pursue TVE are necessary. Incentives can be of at least three types: advanced placement/time shortened, tuition waivers, and guaranteed job placement.

Advanced placement/time shortened. One effective incentive for youth to pursue postsecondary TVE is to provide opportunities to receive advanced placement for course work taken in high school. This results in either less time to complete a postsecondary TVE degree or allows them to take more advanced courses. One such program is called Tech Prep and is an U.S. federal priority. Tech Prep is best viewed as a transitional program between secondary TVE and postsecondary TVE and is historically known as the “two plus two” system. In the U.S., the lines between the last years of high school and the first year of college are increasingly blurred as students take college courses while still in high school. In a tech prep curriculum, the last years of high school are closely aligned with the technical college curriculum. Often, students are “dual-enrolled,” meaning that the courses are actually taught by the technical college and count both for a secondary and postsecondary degree.

Tuition Waiver. Most students pursue advanced degrees in order to get a high-paying satisfying job. But pursuing post-secondary education is costly. The lower the costs to pursue TVE relative to other options, the more popular it will be. Hence, any program that makes TVE relatively less expensive is effective. One very effective method is to provide government tuition loans and then reduce these loans after graduation for each year a student works in a related technical area.

Guaranteed Job Placement. Perhaps the most effective way to promote TVE among students is to guarantee employment. In a market economy, there is, of course, no ironclad employment guarantees. Nevertheless, the odds are considerably better if industry is heavily involved in the TVE program. In the U.S., it is common for firms to sponsor a particular TVE program by providing instructional equipment, internship opportunities, and sometime even the instructor. Firms do so because it

provides access to a pool of technicians. Meanwhile, from a student's point of view, it provides increased probability of access to high skills/high wage employment.

Increase Government Support

Relative to general and theoretical education, applied TVE is expensive. Because TVE student outcome objectives are measurable job competencies, TVE mostly provide opportunities for students to practice these job tasks. For this reason, TVE requires instructional labs that include expensive industrial equipment. Government funding of theoretical education because it is cheap is shortsighted; especially, when the outcome is growing numbers of over-educated workers. Informed government policy funds TVE, understanding that it is the keystone to economic growth. Malaysia is an excellent example of a country that understands this truth and has acted accordingly by increasing the availability of TVE. Korea is also active in supporting secondary TVE education. According to the Korean Ministry of Education and Human Resources Development (2004), due to the governmental efforts, the applicants for TVE high schools outnumber available space in the 2005 school year.

Hold Industry Accountable

While industry has the most to gain from solving the “quiet dilemma,” they often are part of the problem. Shortages of technicians can be traced, in some industries, to low wages. Equally important, technicians are often barred from advancement in companies because they lack four-year degrees. Both are serious disincentives. It is time for TVE to be forthright with industry and confront them with these issues. Industry has to both change their employment policies and increase their financial support of educational programs that provide the workforce they needs, namely TVE. In countries like Australia where the TVE system is double the size of the higher education system, the reason is that industry values the qualifications that TVE provides. Government working with industry to increasingly make training relevant to industry requirements goes a long way to solving the dilemma.

Do Not Neglect High School TVE

In light of the importance of post-secondary pre-baccalaureate TVE, there is a tendency to dismiss the importance of high school TVE and argue for its elimination. This is misguided for three reasons. First, experience around the world suggests that a prerequisite for a strong post-secondary TVE system is a strong high school system. The reason is that the high school system tends to be the prime feeder for the post-secondary system. Students who spend their high school years in academic preparation for a university education seldom change their preference to TVE. In the U.S., the majority of pre-baccalaureate post-secondary TVE students who matriculate directly after high school participated in high school TVE. Second, while the key to sustaining a world-class economy is a pool of technicians, it is to be remembered that blue-collar technical workers are by far the largest group (see Figure 1). The skill set of these individuals is best taught in high school TVE. Third, in most countries, the majority of students go to work after high school rather

than to college. If there is no TVE, then, what high school curriculum will prepare these students for the transition from school to work? As an indication, high school TVE is very effective in reducing high school dropout rates because students view the curriculum as relevant to their future and stay in school.

Summary

Worldwide, nations have sought to increase educational levels to compete in the new global economy. Typically these human capital investments have stressed basic, and then university education, neglecting TVE. The result is a “quiet dilemma” or labor market disequilibrium characterized by an oversupply of university graduates concurrent with a shortage of technician level workers. As a result, over-education of university graduates is now a worldwide occurrence. Nations that can avoid this dilemma or resolve it will have strategic advantage over those that cannot. It is wise to remember, as an example, that the labor market for engineers is international, but firms expect/prefer to find technicians in the local labor market and locate where this labor supply exists or where TVE providers can supply training. Thus promoting TVE at both the high school and pre-baccalaureate postsecondary levels should be a major emphasis of national human-capital-development policy. It is an important key to both economic growth and to providing individual economic opportunity.

References

- Bae, S. H., & Song, J. H. (In press). Youth unemployment and the role of career and technical education: A case study of the Korean labor marker, *Career and Technical Education Research*.
- Bishop, J. (1995). *Expertise and excellence*. Working Paper 95-13. Center for Advanced Human Resource Studies. Ithaca, N.Y.: Cornell University
- Carnevale, A., Gainer, L., & Meltzer, A. (1990). *Workplace basics*. San Francisco: Jossey-Bass.
- Dore, R. P. (1976). *The diploma disease: Education, qualification, and development*, Berkeley, CA: University of California, Berkeley.
- Gray, K. (2000). *Getting real: Helping teens find their future*. Thousand Oaks, CA: Corwin Press.
- Gray K. & Herr. E. (1998). *Workforce education: The basics*. Needham Heights, MA: Allyn & Bacon.
- Gray K. & Herr, E. (2006). *Other ways to win: Creating alternatives for high school graduates* (3rd Ed.). Thousand Oaks, CA: Corwin Press.

- Korean Education Development Institute (KEDI). (1985-2005). *Statistical yearbook on education in Korea*. Seoul: Author.
- Korean Ministry of Education and Human Resources Development. (2004, December 22). *The 2005 Career and Technical Education high school recruitment results*, Unpublished ministerial media statement (In Korean). Seoul: Author.
- Korean Ministry of Labor. (2004, December 10). *The 2004 labor demand survey results*. Unpublished ministerial media statement (In Korean). Seoul: Author.
- Korean Prime Minister's Office. (2004). *Special Report on Youth Unemployment*, Unpublished government document. Seoul, Korean: Author.
- Hecker, D. (2001, November). Occupational employment projections to 2010, *Monthly Labor Review*, 124, 57-84.
- Hecker, D. (2005, November). Occupational employment projections to 2014, *Monthly Labor Review*, 128, 70-101.
- Livingstone, D. (1998). *The Education-jobs Gap*. Boulder, CO.: Westview Press.
- McCromick, A., & Knepper, P. (1996). *A descriptive summary of bachelors degree recipients one year later*. (NCES Publication No. 96-158). Washington, DC: US Department of Education.
- McLean, G. N., Osman-Gani, A. M., & Cho, E. (Eds.) (2004). Human resource development as national policy. *Advances in Developing Human Resources*, 6(3).
- National Association of Manufacturers (NAM). (2005). *2005 Skills gap report: A survey of the American manufacturing workforce*, Washington D.C: Author.
- Paprock, K. E. (2006). National human resource development in transitioning societies in the developing world: Introductory overview. *Advances in Developing Human Resources*, 8(1), 12-27.
- Pennsylvania Economic League. (1996). *Building a world-class technical workforce: The key to a competitive greater Philadelphia*, Philadelphia: Author.
- People. (2002, December 31). More college graduates put strain on China's job market, Retrieved on May 20, 2006, from <http://china.org.cn/english/NM-e/52528.htm>.

- People's Daily. (2004, September 16). China in serious shortage of skilled workers, Retrieved on May 22, 2006. from http://english.people.com.cn/200409/16/eng20040916_157294.html.
- Perkins, A. & Perkins, M. (1999). Eyes wide shut. *Harper Business Review*
- Porter, M. (1990). *The competitive advantage of nations*, New York: The Free Press.
- Pryor and Schaffer (1997, July). Wages and university education: a paradox resolved. *Monthly Labor Review*, 120 (7). 3-16.
- Pucel, D. (1995). Occupationally specific mathematics requirements and application contexts. *Journal of Industrial Teacher Education*, 32(2), 51-75.
- Seth, M. J. (2002). *Education fever: Society, politics, and the pursuit of schooling South Korea*, Honolulu: University of Hawaii.
- Silvestri, G. (1997, November). Occupational employment projections to 2006. *Monthly Labor Review*, 120(11).58-83
- Stern, M. (1992, June 29). Employer survey. *Adult and Continuing Education Today*. 25.
- The Economist. (2000, February 5). *Economic Indicators*. 100.
- The Chronicle of Higher Education. (2005, August 26). *Projections of college enrollment, degrees and high-school graduates*, 16.
- Thurow. L. (1996). *The future of capitalism*. New York: Morrow and Company.
- Thurow. L. (2003). *Fortune favors the bold*. New York: HarperCollins Publishers.
- US Department of Education. (1995). *Baccalaureate and Beyond Data Set*. National Center for Education Statistics (NCES), Washington DC.
- Vocational Training News (2000). *Labor H1-B visa grants*. 3.
- Wall, J., & Passmore, D. (1997). *Economic effects of technicians shortages*. Monograph. State College, PA: The Penn State University.
- World Bank. (1997). *World Development Report: The State in a Changing World*. Oxford: Oxford University Press.
- Zinser, R., & Lawrenz, F. (2004). New roles to meet industry needs: A look at the advanced Technological education program. *The Journal of Vocational Education Research*, 29(2), 85-99

Appendix

High Skill/High Wage Non-Professional Occupations

I. Information Technology

Computer network administrators
Web page(s) creators/administrators
Computer systems installation and maintenance
Computer Repair Technician
Computer Applications Specialist
Information Technical Consultant
Data Retrieval Specialist
Computer training specialist
Communications Systems Installation and Repair
Communications Systems Technical Consultant
Data Entry/processing
Help Desk
Internet design, development, administration
Technical documentation

II. Traditional Crafts

Automotive Technician
Precision Welding
Pipe fitting/plumbing
Heating/Ventilation/Air Conditioning/stationary Engineers
Mason

III. Industrial Manufacturing Technology

Computer Numeric Control Machine Tool Operator: Metal and Wood
Tool and Die Maker
Automated Manufacturing System Technician
Computer Aided Designer
Millwright/industrial Maintenance
Industrial Electrician

IV. Allied Health Career

License Practical Nurse
Dental Hygienist
Surgical Technician
Paramedic
Radiologist
Health Facilities Management
Dietary Management
Health Information Technicians
Cardiology Technologists
Respiratory Therapists

V. Service industries

Paralegal
Professional Chef
Recreation/restaurant management
Law Enforcement
Fire Prevention
Court/conference Reporter
Interpreter
Landscape Management

VI. Electronic

Avionics
Electronics Tech
Electro-mechanical Repair Tech
Mobile Electronics Installation and Repair

VII. The Arts

Computer Graphic Designer
Animated Graphic Designer
Lighting Design/Installation/Repair
Cinematography
Custom/Set Design/Installation

SYSTEMATIC REVIEWS OF RESEARCH IN TVET: THE BEST AVAILABLE EVIDENCE FOR POLICY AND PRACTICE

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Abstract

This paper reports on the key steps in the conduct of a systematic review of research in technical and vocational education and training (TVET). It draws from the recent experience of the National Centre for Vocational Education Research Ltd. (NCVER) in Australia in undertaking a systematic review of research on the extent to which education and training makes a difference to the participation of older workers in the labour market. The review process allows for different studies to be weighted for relevance and quality of findings to answer a given question. The ultimate effect of this is that research can influence a review's conclusion only when based on agreed guidelines, and when the reviewers have confidence in the research. This approach uses a team of reviewers to reduce potential bias and the outcome is a collective one. A balanced and relevant synthesis of the findings ensures the best available evidence is reported.

Key words: Research reviews, vocational and technical education, Australia

Introduction

In 2004, the National Centre for Vocational Education Research Ltd. (NCVER) in Australia undertook for the first time a systematic review of research. This paper describes the process and lessons learnt regarding the application of the systematic review of research model to questions about vocational education and training policy.

This model of secondary research was pioneered by the Cochrane Collaboration in 1970s so that decisions on how to treat patients can be soundly based on the best available evidence. Increasingly, this model has come to be applied in the social sciences by other groups such as the Campbell Collaboration. A key organisation working in the field of systematic reviews of research is the EPPI-Centre—the Evidence for Policy and Practice Information and Coordinating Centre, Social Science Unit, Institute of Education, University of London. It has developed a model of systematic reviewing that can be followed and adapted by other organisations across a range of disciplines, including education.

Systematic reviews in the education sector are in relative infancy. One organisation undertaking systematic reviews in the field of education is the Learning and Skills Development Agency (LSDA) also in the United Kingdom. The LSDA has used the EPPI-Centre model for reviews and its own adaptation or hybrid model for other reviews.

In 2004, NCVER chose to adapt the EPPI-Centre model for its first systematic review of existing research. The selected topic was ‘mature-aged workers’ because encouraging older workers to remain in the labour force is cited as the major means of addressing the projected overall reduced supply of Australian labour. The question identified by policy makers for NCVER’s first review was: What evidence is there that skill development activities for the mature-aged (45 years and over) lead to improve attachment to the labour market and to improve productivity?

What is a systematic review of research?

A systematic review of research is a decision-making tool for policy and practice. It uses explicit and rigorous methods to identify, critically appraise and synthesise all relevant research (both published and unpublished) around a focussed review question.

A systematic review is a piece of research in its own right, using explicit and transparent methods that follow a standard set of stages. This enables it to be replicated. It is also undertaken by a team and the outcome is a collective one—which reduces potential bias.

The review process allows for different studies to be weighted for relevance and quality of findings to answer a given question. The ultimate effect of this is that research can influence a review’s conclusion only when based on agreed guidelines, and when reviewers have confidence in the research.

The aim of the systematic review is to develop a concise summary of the best available evidence that addresses the clearly defined question. While the question addressed by a systematic review may be the same as posed by a primary researcher, the difference is that there must be a sufficient, but not unmanageable, quantity of primary research that exists on the topic to make conducting a review worthwhile (Averis & Pearson, 2003). For further details on the differences between systematic reviews and traditional literature reviews, and common misconceptions of systematic reviews, read Needleham (2002) and Petticrew (2001).

Systematic reviews in vocational education and training

While the scientific or experimental approach is considered to ensure objectivity or non-bias in the findings of medical research for systematic reviews, in social science research the use of control and treatment groups for comparative purposes is rare and often impractical or unethical. A single intervention is going to be difficult to isolate as usually a multitude of factors impact on an individual’s choice to undertake vocational education and training (VET) or on the outcomes of VET. Thus, determining a direct link between an intervention and outcome is more difficult in VET than in health care with its randomised controlled trials.

Dawe (2003) notes that a broad definition of research is used for VET research in Australia: a ‘systematic and organised way of finding answers to questions’. In addition, VET research often comprises of a combination of different research methods.

Qualitative research is centrally concerned with understanding things rather than measuring them. During 1990s, the development of approaches to include qualitative evidence in systematic reviews of research has become important in health care (Pearson, 1994), social science (Spencer et al., 2003), and education (Evidence for Policy and Practice Information and Co-ordinating Centre, 1993). A meta-synthesis uses textual analysis to synthesise findings from qualitative research studies and those quantitative studies where numerical data cannot be combined. The synthesised findings are usually presented in the form of a structured narrative, with tables summarising the findings from the reviewed studies.

A narrative summary is used in reporting the findings of the first systematic review of research that NCVER has undertaken (Thomson, Dawe, Anlezark & Bowman 2005). In a narrative summary, systematically analysing the similarities and differences of findings from different approaches allows conclusions to be drawn that go beyond statements such as ‘more research is needed’.

It was anticipated that a number of benefits could be derived from NCVER’s systematic review of research. These included the enhancement of:

- the interaction between researchers and policy makers in the VET sector through working together towards a common goal
- capacity building for quality research
- the critical assessment of a body of VET-related research around a particular topic relevant to Australian VET
- the avoidance of duplicating research which has already been undertaken in another research setting
- identification of the gaps in research, or areas which need further research
- an infrastructure for future systematic reviews of research.

NCVER’s eight-step model

For the conduct of a sound systematic review of research, a protocol must be adhered to. The steps are set out in a linear fashion, but it is important to note that it is an iterative process, and that often stages provide information that is relevant to others, and may be replicated and refined. Our eight-step model included:

1. Identify the question
2. Develop a framework document
3. Search for all relevant research
4. Select studies to be included
5. Appraise selected studies

6. Synthesise the findings to answer the question
7. Present findings to the stakeholders
8. Disseminate results

Step 1—Identifying the question

Defining the review question is the most critical part of the review because other aspects of the process flow directly from this. The focussed question provides the same role and is as important as the research question or hypothesis in primary research. While the narrowing of scope in a systematic review may be perceived as a disadvantage compared with traditional literature reviews, it helps to ensure the review will provide as conclusive a summary as evidence permits.

The review question needs to be relevant to policy makers and to have a body of research behind it. It should also be one that does not require an immediate answer, as a review will typically take up to 12 months.

The review question should be specific and focussed, and address the *population* or participants of interest, *intervention* for investigation or phenomenon of interest, and *outcomes* considered most important for assessing the results and, if focussing on effectiveness, usually including a comparison. This provides the basis for development of the research selection criteria without which there is opportunity for bias, consciously or unconsciously, by reviewers.

Involvement of stakeholders

The systematic review process supports user engagement. NCVER established a steering group which included high level representatives from state and territory government VET authorities, two Australian government departments (Department of Employment and Workplace Relations, and Department of Education, Science and Technology), the Australian National Training Authority, and the research community. The Australian National Training Authority which commissioned this project ceased to exist on 30 June 2005 and its functions were absorbed into the Australian Department of Education, Science and Technology. The chairperson of the group is the Managing Director of NCVER.

Following an overview of the systematic review process, the steering group discussed the current policy issues around the topic of ‘mature-aged workers’, and other research being undertaken in this area. The group then focussed on defining a very specific population, intervention and outcome of interest. The review question was refined from the discussion which also included defining each term in the question and setting the parameters for the search strategy.

Capacity building for quality research

A call for expressions of interest to be external reviewers for the first systematic review was placed on the NCVER website and sent to the members of the Australian Vocational Education and Training Researchers Association (AVETRA), the Australasian Evaluation Society, and other research bodies and stakeholders. Reviewers were required to attend a training workshop held in Adelaide on 11 June,

and appraise at least six studies by the end of July 2004. From the many responses, 10 external reviewers were chosen for their research expertise and experience, and availability within the project time-frame.

After discussion with the external reviewers at the training workshop, the evaluation template developed by the project team was refined, and further guidelines for critical appraisal of research studies were prepared.

Step 2—Developing a framework document

The framework document for the NCVET systematic review of research includes:

- the question to be addressed by the review
- the definitions of the terms in the question
- the details for the comprehensive search strategy to identify research studies
- the criteria to be used to screen for research studies relevant to the question
- the criteria for appraising the quality of the research studies to be included in the review
- the method of synthesising the findings from the included research studies, that is, the evidence to answer the specific review question.
- the requirements of the final report

Involvement of stakeholders

The draft framework was distributed for comment to a broad consultation group, including all state and territory government VET stakeholders, interested people from the research community, and those with specific expertise in systematic reviews from overseas.

What we learnt

It was useful to have the advice of the broader consultation group as well as the steering group to guide the development of the framework that arises from, and supports the review question. This step also alerts stakeholders to the current research and encourages links to related projects in progress.

Step 3—Searching for all relevant research

A coherent search strategy to identify all potentially relevant studies to the review question is recorded in detail in the framework so that the process is transparent and replicable. The full search strategy involves hand and electronic searching (databases, website and journals and unpublished reports, dissertations or projects in progress) as listed in the framework. For NCVET's first systematic review, the inclusion criteria which selected studies had to meet, included that the study:

- was in English, from Australia and overseas
- was recent, that is, from 1996 onwards
- matched keywords deemed relevant to the review question.

The search for relevant studies was done by the NCVET library technicians, based on the information in the study title and abstract. Searchers included all material within scope, that is, meeting the agreed inclusion criteria, including population, intervention and outcome definitions, within the framework.

A database was developed to contain the results of searches and selection (using agreed inclusion and exclusion criteria). Each individual study was assigned a specific ID number as it was recorded in the search log, and this ID number stayed with the particular study throughout the process and in the final report.

Involvement of stakeholders

The steering group and other stakeholders were provided with the list of studies to be included for in-depth review and a second list of those materials excluded, and further consulted to ensure that no key studies were missed.

What we learnt

A further screening process (see next step) was needed, based on the full documents. In this first review all relevant material was included but policy documents were not useful because they did not provide evidence to answer the review question. Rather, most policy documents were based on assumptions or did not reference any evidence on which they were based. However, any relevant references which are quoted in policy documents should be checked for evidence related to the review question.

Step 4—Selecting studies to be included

As noted in NCVET's report: *An aid to systematic reviews of research in vocational education and training in Australia* (Anlezark, Dawe & Hayman, 2005), the search results are screened through an iterative process. During the search studies are assessed by the searchers as relevant based on the information in their title and abstract. As the screening continues the selection criteria are applied more strictly.

What we learnt

Only studies which provide evidence or new analysis of literature or data should be included for in-depth evaluation. A further screening of the full documents (rather than just abstracts and titles), is required to ensure only those studies which provide evidence relevant to the review question, and in which we can have confidence in their findings, are included in the final report.

Additional time should be allowed to check primary references which are provided in selected studies in order to include these, where appropriate, in the review process.

Step 5— Appraising selected studies

In NCVER's first systematic review each selected study was appraised for relevance and quality of the research findings to the review question by two reviewers independently, and then they had to reach consensus on the combined appraisal. The studies were allocated to reviewers to reduce potential bias (each pair only being assigned one study in common where possible) and each reviewer appraised or evaluated six of 33 studies included for in-depth evaluation.

Capacity building for quality research

Communication between the reviewers and the project team was encouraged and further modifications to the guidelines were made after each reviewer had evaluated one study. Frequently asked questions and answers were logged and distributed to all reviewers. This assisted consistency and quality while maintaining independence of reviewers.

What we learnt

Although reducing bias, the method used to allocate studies to individual reviewers was found to result in some inconsistency in the appraisal process. It also meant that each reviewer had only read a few of the studies. 33 studies were included for in-depth evaluation for the first review although most studies were appraised as having little relevance or no evidence to answer the review question. Since none of the reviewers or project team had read all 33 selected studies, no-one had the full picture of all the studies and this made the synthesis of the findings (next step) more difficult.

It was noted that expertise in the methodologies used in the selected studies was required by the reviewers so that studies should be assigned to reviewers according to such expertise where needed (e.g. economic modeling).

For future NCVER systematic reviews the inclusion and exclusion criteria will be applied more strictly and only quality evidence relevant to the review question will be included in the in-depth evaluation and synthesis of findings. Once the review team has agreed that the study will be included in the synthesis, a database will be used to store the information about all included studies. The findings in the study which are relevant to the review question will be recorded along with the best evidence quoted from the document to support that finding. These will be recorded by the reviewer in consultation with one or more other members of the review team. They will also be involved in the synthesis of the findings.

Step 6—Synthesising the findings to answer the review question

The sixth step of the systematic review process is the synthesis of the findings or evidence from the quality research studies to answer the review question. It was at this stage in the NCVER's first systematic review of research that NCVER appointed one of the external reviewers to do the synthesis of the findings for the final report.

The findings relevant to the review question from the studies in whose findings we can have confidence are firstly extracted or recorded and then pooled. The aim of the process is to generate a set of statements that adequately represents the aggregation of the findings or evidence on the basis of similarity of meaning. These categories are then subject to meta-synthesis in order to produce a set of synthesised findings or key messages that can be used as the basis for evidence-based policy and practice.

What we learnt

For future NCVER systematic reviews of research, the key reviewer and a second reviewer will be selected at the beginning of the review project. In this way they will fully understand the development of the question, be involved in screening the studies for in-depth evaluation, and be familiar with all included studies before synthesising the evidence and compiling the final report.

For future NCVER systematic reviews of research, an electronic database will be used to manage the relevant findings or evidence from the included studies. NCVER will be using the Joanna Briggs Institute Qualitative Assessment Review Instrument (JBI_QARI) software package to assist with the meta-synthesis of evidence. This will assist the reviewers with the grouping and categorisation into synthesised findings to answer the review question. However, the reviewers will need to exercise some degree of judgement as synthesis uses interpretative techniques to summarise the findings of individual studies into a product of practical value for the VET sector. The features of content analysis include the need to read and re-read the text to identify the meaning of the content, and the formation of statements that accurately describe the content.

Step 7—Present findings to the stakeholders

The final report, in the NCVER standard report format (Key messages—one page; Executive summary—three pages, and Analysis of findings—25 pages) tries to answer the review question by detailing the evidence. Supporting documents detail the studies found in the initial search, the number of studies excluded and reasons for exclusion.

Involvement of stakeholders

The draft final report was distributed to the steering group members and reviewers for comment. This resulted in refinement of the final report before publication.

What we learnt

We learnt from the NCVER's first systematic review of research that it may be that only a small number of studies will be identified as key studies; that is, studies in which we can be confident of the findings, because they rate highly for relevance to the review question and for quality in research methodology, data collection, analysis and reporting.

The systematic review also provided an opportunity to identify gaps in current research and implications for further research.

Strengths of the review

The final report of the findings may be based on a small number of key studies, but these are the result of an exhaustive search and in-depth review by a collaborative team of experienced researchers in the VET sector. Another strength is that this well-documented, systematic and transparent approach enables the review to be updated by the same or different authors.

Another important strength of the systematic review of existing research is the capacity building, through the transparent and collaborative approach, to improve the quality of future VET research in Australia. This review provided policy-makers, other stakeholders and researchers with the opportunity to look at the quality of our vocational education and training research along with related research from other countries.

For reviewers, there were many positive outcomes as demonstrated in their feedback on the review process. For some reviewers, this included the need to re-assess their ideas about the way they write their research reports or articles for publication. It also caused them to re-assess the nature, purposes and scope of literature reviews, and the role of referees and editors.

Step 8—Disseminate the findings

The final report (Thomson, Dawe, Anlezark & Bowman, 2005) was distributed to stakeholders and placed on the NCVER's website as the *Supporting document*. For purposes of transparency, details of the process were also published and placed on the website (Anlezark, Dawe & Hayman, 2005).

Involvement of the stakeholders

Presentations of the findings from the first systematic review of research and our learning about the review process are shared with stakeholders through research forums, conferences and other channels as appropriate.

NCVER seeks topics for future systematic reviews of existing research from VET stakeholders. For example, a recent systematic review of existing research focussed on the key factors required to ensure indigenous people achieve the outcomes they aspire to personally and for their communities (Miller, 2005). This report provides evidence to enable vocational education and training policy-makers and practitioners to act and move forward in developing training that meets the aspirations and needs of indigenous Australians. A systematic review currently in progress is on the topic of 'small business and training', that is, what strategies achieve the participation of small business managers and their employees in TVET?

Summary

In establishing systematic reviews of research and reviewer groups, NCVET intends to encourage an informed and robust critique of research related to policies and practice in VET and to bring research directly into the decision-making processes at the level of both policy and practice.

The key benefits of its systematic review of research include:

- researchers and policymakers working together
- critical assessment of body of research on a question of significance to policy-makers
- greater awareness of what makes for quality research
- identification of gaps in research
- an infrastructure for future systematic reviews of research

NCVER seeks topics for future systematic reviews of existing research of relevance to TVET stakeholders.

References

- Anlezark, A., Dawe, S., & Hayman, S. (2005). *An aid to systematic reviews of research in vocational education in Australia*, National Centre for Vocational Education Research, Adelaide. Retrieved in November 2005, from <http://www.ncver.edu.au/publications/1575.html>.
- Averis, A., & Pearson, A. (2003). Filling the gaps: Identifying nursing research priorities through the analysis of completed systematic reviews. *JBI reports vol.1*, pp.49-126. Adelaide: The Joanna Briggs Research Institute.
- Campbell Collaboration website. Retrieved in November 2005, from <http://www.campbellcollaboration.org/FraAbout.html>.
- Cochrane Collaboration website. Retrieved in November 2005, from <http://www.cochrane.org/>.
- Dawe, S. (2003). *Basing policy and practice on sound evidence*, conference paper for the Australasian Evaluation Society 2003 International Conference. Adelaide: National Centre for Vocational Education Research, Retrieved in November 2005, from <http://www.ncver.edu.au/pubs/confs/cpo3conf.pdf>.

- Evidence for Policy and Practice Information and Coordinating Centre website. Retrieved in November 2005, from http://eppi.ioe.ac.uk/EPPIWeb/home.aspx?page=about_eppi.htm.
- Learning and Skills Development Agency website. Retrieved in November 2005, from <http://www.lsda.org.uk/>.
- Miller, C. (2005). Aspects of training that meet Indigenous Australians' aspirations: A systematic review of research. *National Centre for Vocational Education Research*, Adelaide. Retrieved in November 2005, from <http://www.ncver.edu.au/publications/1625.html>.
- Needleham, I.G. (2002). A guide to systematic reviews, *Journal of Clinical Periodontology*, vol.29, no.3, pp.6-9, Blackwell Munksgaard, Denmark.
- Pearson, A. (2004). Balancing the evidence: Incorporating the synthesis of qualitative data into systematic reviews, *JBI Reports*, vol.2, The Joanna Briggs Institute, Adelaide, pp.45-64.
- Petticrew, M. (2001). Systematic reviews from astrology to zoology: Myths and misconception, *British Medical Journal*, vol.322, pp.98-101.
- Spencer, L., Richie, J., Lewis, J. & Dillon, L. (2003). *Quality in qualitative evaluation: A framework for assessing research evidence*. London: Government Chief Social Researcher's Office. Retrieved in November 2005, from http://www.policyhub.gov.uk/docs/qqe_rep.pdf.
- Thomson, P., Dawe, S., Anlezark, A. & Bowman, K. (2005). *The mature-aged and skill development activities: A systematic review of research*. Adelaide: NCVER. Retrieved in November 2005, from <http://www.ncver.edu.au/publications/1574.html>.

IMPACT OF INDUSTRY EXPOSURE ON MACHINE SHOP SKILLS DEVELOPMENT

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Abstract

This study made use of pre-post research method using descriptive statistics. It aimed to determine the impact of the industry exposure program on machine shop knowledge, attitudes, habits and skills development of mechanical engineering students from selected academic institutions in Davao Region, namely: the University of Southeastern Philippines (USEP), the Ateneo de Davao University (AdDU), the University of Mindanao (UM), and the Rizal Memorial Colleges (RMC). Paired t-test was used in treating the data to determine the significance of the level of machine shop skills and knowledge and attitudes and habits. Twenty Six, 4th year mechanical engineering students who were enrolled in the industry exposure or on-the job training (OJT) were the respondents of the study. The findings of this research show that: (1) Level of competency in over-all skills of the students was rated Low before the industry exposure. After the industry exposure the students obtained Moderate level in the over-all skills. In the shaper and milling operations the students got High rating scale. These results indicate that the industry exposure contributed significantly to the students' KASH Machine Shop. There is a significant difference on the levels in all areas of attitudes and habits before and after the industry exposure.

Key words: Industry exposure, student attachment, skills development, vocational technical education.

This technical paper was presented during the Seminar – Workshop on Curriculum Evaluation for Relevance to Industry on April 4-8, 2005 at Tower Inn, Davao City. This was sponsored by the University of Southeastern Philippines and SEAMEO VECTECH.

Introduction

Industrial progress always depends on the level of technological ability. And such ability is not something bottled up in a laboratory. It is in every individual the way they are trained and educated. Skills, knowledge, habits and attitudes must be nurtured not only at home but in the schools and in the industry as well. Thus, there is a need to develop the basic skills such as in machining. However, due to the absence of some equipment in schools, the industry provides what the schools cannot do.

Industry exposure has been around for sometime. It represents yet another traditional concept enjoying a much-deserved renaissance. Like rediscovering art deco, old brass work, and the blacksmith's art, job-searchers have discovered that

doing exposure is part of a smart career strategy. It has been considered as the backbone of engineering and technology education and why academic institutions have aggressively promoted them: “Industry Exposures lead to jobs.”

The direct benefit of industrial exposure will help improve the capability of the students in facing the practical aspects of the actual job operation and enhance their knowledge in machine shop practices. The academic institution will have an advantage of having a wider and more realistic laboratory, and an opportunity to extend training programs to industry personnel. The industry will also have the following benefits: additional manpower, ready source of training needs and manpower requirement, and lower training expenses for personnel. Industry exposure is important to provide exemplary technical training for student- trainees to become more familiar with the workplace traders. It provides experience on a variety of machine tools particularly the different machine shop operations, computer numerical control (CNC) machine, Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM), Related Math, Blueprint Reading, Basic Metallurgy and Heat Treating. It is also a unique opportunity for students to gain a “Hands-on Understanding” of what it takes to fabricate and to understand many of the subjects taught at the university. In order to become successful in the future, a student should be trained to utilize the theoretical knowledge in the practical applications meet, and to get some understanding of the social structure and organization of a company.

It is observed that not all engineering institutions offering mechanical engineering have industry exposure program in their curriculum, this study sought to compare the impact of the industry exposure program on the level of machine shop skills.

Objectives

The objectives of the study were to find out:

1. The level of development among mechanical engineering students before their industry exposure in terms of the following machine shop skills and knowledge: performing bench work, lathe, shaper, milling, boring/drilling, honing machine operations, blueprint reading and machine designing.
2. The level of development among mechanical engineering students in terms of the machine shop skills and knowledge after their industry exposure.
3. Whether there is a significant difference between the level of machine shop skills and knowledge among mechanical engineering students before and after the industry exposure.
4. The level of development among mechanical engineering students before their industry exposure in terms of attitudes and habits;
5. The level of development among mechanical engineering students after their industry exposure in terms of attitudes and habits.
6. Whether there is a significant difference between the level of attitudes and habits among mechanical engineering students before and after the industry exposure.

7. Whether the students were given hands-on training on machine shop skills and knowledge and attitudes and habits during their industry exposure.

Theoretical And Conceptual Framework

Theory Base

This study is anchored on the claim of the President of the City University of Hong Kong Professor H K Chang (June 7, 2001) who stated that the industrial exposure or on-the job training as an invaluable opportunity for students not only to gain hands-on industrial experience but also to immerse themselves in a different economic and cultural milieu, which is an integral part of university education. The research framework of this study can be summarized in Figure 1.

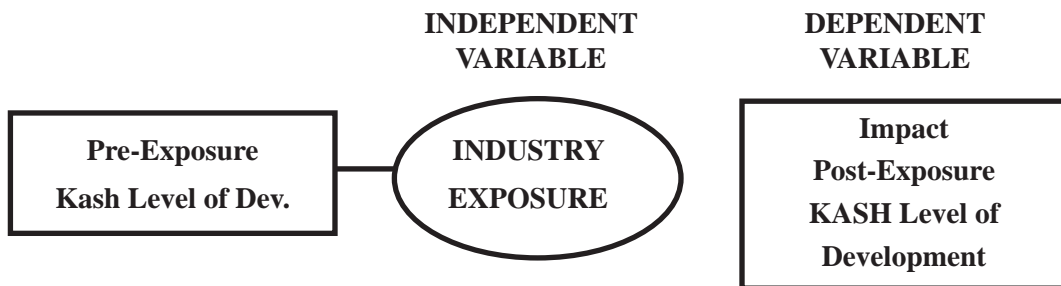


Figure 1. The conceptual framework of the study.

Showing the relationships between the antecedent (?), Independent and dependent variables.

Scope and Limitation of the Study

The machine shop skills and knowledge in this study are limited to bench work, lathe, shaper, milling, drilling/boring, honing machine operations and blueprint reading and machine designing, and the critical attitudes and habits such as: punctuality and attendance, productivity, compliance to 5”S, and behavior and attitudes towards work.

Definition of Terms Used

Impact. It is the term used to describe the difference in the level of development of students/trainees before and after the industry exposure.

Industry Exposure Program. It refers to the On-the Job Training of the 4th year mechanical engineering students.

Machine Shop Skills and Knowledge. They refer to the ability to do something well; techniques and expertise. In this study, they are the skills and knowledge required by the mechanical engineering students in the schools and in the metal industry during industry exposure.

Attitudes and habits. In this study, they refer to mental set that affects how a person will view something else, the feelings and beliefs that largely determine how a person perceive their environment and the manner in conducting oneself.

In this study, it refers to the following: punctuality and attendance, productivity, compliance to 5'S, and behavior and attitudes towards work.

Methodology

This section discusses the methods and the selection of respondents, procedure in gathering the data, and the data tool. This study made use of a descriptive method of research. Pertinent data were obtained through evaluation using an evaluation instrument to establish the baseline data on the level of skills and knowledge before and after the industry exposure program among the 4th year mechanical engineering students/trainees. Similarly, the level of development of attitudes and habits was also established.

The researcher selected the respondents of the study composed of regular 4th year mechanical engineering students of the University of Southeastern Philippines (USEP), Ateneo de Davao University (AdDU), University of Mindanao (UM), and Rizal Memorial Colleges (RMC), enrolled in the Industry Exposure program during the 1st Semester of School Year 2002-2003. Sixteen were from USEP, four from AdDU. Four from UM and two from RMC. The steps which were observed in conducting this investigation involved the following: (1) permission to conduct the study (2) facilitation of the industry exposure (3) conduct of the evaluation (4) collation of data gathered

Hands-on Training during the Industry Exposure

The student trainees were given hands-on training during their industry exposure. USEP students underwent a minimum of 320 hours industry exposure as part of their requirement in the curriculum, while UM, AdDU and RMC student trainees have 200-hour industry exposure in lieu of seminar and field trips. The industry exposure of the above mentioned institutions (AdDU, UM, RMC) is optional on the part of the students.

Data Tool

The researcher constructed a Knowledge, Attitudes, Skills, and Habits (KASH) evaluation instrument and had it validated by experts from the metal industry and from the school. At the beginning of School Year 2002-2003, before the students/trainees underwent the industry exposure, they were pre-tested by four evaluators, two were from schools and two were from industry using the said instrument. At the end of their industry exposure, they were post-tested by the same evaluators mentioned above using the same instrument.

The data tool is composed of sixty-eight (68) items broken into two categories: Part I deals on skills and knowledge and Part II deals on the attitudes and habits. The levels of development of skills are described below with their corresponding equivalent points or ratings.

Level of Development	Description	Ratings
Poor/very low	The student/trainee's machine shop skills and knowledge and attitudes and habits are developed approximately from 0-20%.	1
Fair/ low	The student/trainee's machine shop skills and knowledge and attitudes and habits are developed approximately from 21-40%.	2
Satisfactory/ moderate	The student/trainee's machine shop skills and knowledge and attitudes and habits are developed approximately from 41-60%.	3
Very Satisfactory/ high	The student/trainee's machine shop skills and knowledge and attitudes and habits are developed approximately from 61-80%.	4
Outstanding/very high	The student/trainee's machine shop skills and knowledge and attitudes and habits are developed approximately from 81-100%.	5

Validation of Instrument

A group of experts from metal industries and faculty members who were involved in the industry exposure program were requested to review the instrument. The instrument was also validated against the checklist of machine shop knowledge and skills (National Manpower and Youth Council- NMYC Brochure for Metals and Engineering Sector, 1990). A series of three revisions were done on the skill evaluation instrument before the same was finally reproduced upon approval of the experts.

Findings

This part presents the results of the KASH evaluation of the 26 respondents who were fourth year mechanical engineering students of USEP, AddU, UM, and RMC.

Pre-Industry Exposure

Table 4.1 shows the level of development among mechanical engineering students before their industry exposure in seven areas of shop knowledge and skills. The skills in blueprint reading and machine designing operations are as follows: interpretation of detailed and assembly drawing, identification of symbols, tolerance, fits, and limits, and designs and estimates. The milling and honing machine operations obtained Very Low level because these machines could not be found in the academic institutions. Students got ratings of Low and Very Low in areas of skills and knowledge before exposure because of the following reasons:

a) some of the machines in the laboratory were non-functional and defective; b) inadequate machine shop equipment c) some faculty handling the course had inadequate knowledge and were unskilled in metal technology; and d) some academic institutions were not complying with the minimum standard requirements of laboratory facilities as required and mandated by the CHED and TPEAME.

Table 4.1 *The Level of Development on Knowledge and Skills among Mechanical Engineering Students Before the Industry Exposure*

Shop Knowledge and Skills	Mean Score	SD	Equivalent Adjectival Rating
1. Benchwork Operations	1.52	0.26	Low
2. Lathe Machine Operation	1.77	0.42	Low
3. Shaper Machine Operation	1.57	0.2	Low
4. Milling Machine Operation	1.32	0.15	Very Low
5. Drilling/Boring Machine Operation	1.55	0.23	Low
6. Honing Machine Operation	1.42	0.12	Very Low
7. Blueprint Reading and Machine Designing	2.04	0.55	Low
OVERALL	1.60	0.26	Low

Post-Industry Exposure

It can be gleaned from Table 4.2 that the mean scores of the seven areas vary from one operation to another. The students' exposure and actual cooperation of appropriate machines enabled them to get Moderate Rating in the benchwork, lathe, miling,drilling/boring and honing machine operations.

Table 4.2. *The Level of Development on Knowledge and Skills among Mechanical Engineering Students After the Industry Exposure*

Knowledge and Skills	Mean Score	SD	Equivalent Adjectival Rating
1. Benchwork Operations	3.43	0.41	Moderate
2. Lathe Machine Operation	3.49	0.27	Moderate
3. Shaper Machine Operation	3.58	0.30	High
4. Milling Machine Operation	2.94	0.36	Moderate
5. Drilling/Boring Machine Operation	3.47	0.28	Moderate
6. Honing Machine Operation	2.81	0.41	Moderate
7. Blueprint Reading and Machine Designing	3.65	0.55	High
OVERALL	3.34	0.25	Moderate

However, since trainees were assigned from one machine to another for a short period of time, mastery and familiarization should also be given equal importance. On shaper operation and blueprint reading and machine designing the student obtained High Level training because trainees were given enough exposure in these particular areas. Student-trainees had already experienced the blueprint reading and machine designing while they were in the schools and more so when they were trained while having their industry exposure. The Moderate and High ratings obtained by the student after the industry exposure could be due to the following: a) almost all the equipment, hand tools and all types of measuring devices are found in the metal industries; b) student-trainees were given more time on hands-on practice in the industries; c) all the industries gave them the opportunity to assume responsibilities; d) student-trainees got high sense of value for what they have learned, high competence in their ability to perform the task for which they were trained, and high levels of confidence in their ability to perform the trained skill.

Test of Significance on the Pre- and Post-Industry Exposure KS of Students

Table 4.3 shows that Pairs 1-8 of knowledge and skills have negative computed t-values that are significant at $\alpha = .05$. All the null hypotheses on the differences of the pretest and posttest mean scores in each of the eight pairs were rejected. This means that each skill and knowledge to be developed is significantly higher than their level of development before the industry exposure. The skills were developed because of the hands-on training provided to the trainees during the exposure. Another reason why the trainees lacked experience before the exposure was due to the inadequacy of equipment in their respective schools. In fact, some faculty handling the subject were not familiar and not exposed in the metal industry.

Table 4.3. *Paired T-Test on The Significance of The Difference Between The Level of Development of Skills and Knowledge Before and After The Industry Exposure*

Knowledge and Skills	Mean Before	Mean After	Computed t-value	df	Probability Level
Pair 1 Benchwork operations Pretest-posttest	1.5230	3.4356	-19.256 ^S	26	.000
Pair 2 Lathe machine operations pretest-posttest	1.7748	3.4933	-21.110 ^S	26	.000
Pair 3 Shaper machine operations pretest-posttest	.5693	3.5789	-32.655 ^S	26	.000
Pair 4 Milling machine operations pretest-posttest	1.3222	2.9389	-26.873 ^S	26	.000
Pair 5 Drilling/boring machine opr'tns pretest-posttest	1.5526	3.4744	-29.207 ^S	26	.000
Pair 6 Honing machine operations pretest-posttest	1.4200	2.8122	-18.886 ^S	26	.000
Pair 7 Blueprint reading and designing machine pretest-posttest	2.0367	3.6533	-19.929 ^S	26	.000
Pair 8 Over-all pretest posttest	2.1215	3.3407	-24.557 ^S	26	.000

S- Significant at $\alpha = .05$

(Negative values of t are due to the fact that posttest mean scores are larger than pretest mean scores)

Students' Attitudes & Habits Prior to Industry Exposure

Table 4.4 shows the result of the mean scores in 4 areas of attitudes and habits. Items on Punctuality and Attendance, Productivity, and Behavior and attitudes towards work got High level. This is because the students were already trained in the school. Meanwhile Compliance to 5'S (Sort: Keeping and disposal of items, Systemize: Arrangement of necessary items, Self-Discipline: Spontaneity and initiative, sweep: Cleanliness in the workplace, and Sanitize: Maintenance and housekeeping) obtained Moderate level because students were not given updates and lecture in this area. This could also be due to the non- inclusion of 5'S in the course content of the subject.

Table 4.4. *The Level of Development on Attitudes and Habits among Mechanical Engineering Students before Industry Exposure*

Attitudes and Habits	Mean Score	SD	Verbal Description
1. Punctuality and Attendance	3.99	0.39	High
2. Productivity	3.77	0.48	High
3. Compliance to 5'S	2.63	1.16	Moderate
4. Behavior and Attitudes Towards Work	4.48	0.31	High
OVERALL	3.72	0.31	High

Students' Attitude and Habits After the Industry Exposure

Looking into the different areas after the industry exposure, all the areas obtained a Very High level. This means that trainees were more attentive, and more mature during the actual operation. The rating of Very High in the over-all operations means that all the areas were given more attention in the industry exposure.

Table 4.5. *The Level of Development on Attitudes and Habits among Mechanical Engineering Students after the Industry Exposure*

Attitudes and Habits	Mean Score	SD	Equivalent Adjectival Rating
1. Punctuality and Attendance	4.80	0.29	Very High
2. Productivity	4.58	0.39	Very High
3. Compliance to 5'S	4.38	0.39	Very High
4. Behavior and Attitudes Towards Work	4.91	0.2	Very High
OVERALL	4.67	0.2	Very High

Test of Significance on the Pre-Industry Exposure of Students' Attitude and Habits

It can be noted that all the computed t values on the areas on attitudes and habits are significant. The Table 4.6 shows that Pairs 9-13 have negative computed t-values that are significant at $\alpha = .05$. All the null hypotheses on the differences of the pretest and posttest mean scores in each of the four pairs were rejected. This implies that in each area on attitudes and habits to be developed after industry exposure is significantly higher than their level of development before the exposure.

Table 4.6. Paired T-Test on The Significance of The Difference Between The Level of Development Attitudes and Habits after the Industry Exposure

Attitudes and Habits	Mean Before	Mean After	Computed t-value	df	Probability Level
Pair 9 Punctuality & attendance pretest-posttest	3.9896	4.801	-11.662 ^S	26	.000
Pair 10 Productivity pretest-posttest	3.7730	4.5770	-9.516 ^S	26	.000
Pair 11 Compliance to 5's pretest-posttest	2.6307	4.3752	-9.092 ^S	26	.000
Pair 12 Behavior and attitudes towards work pretest-posttest	4.4837	4.9137	-5.723 ^S	26	.000
Pair 13 Overall pretest-posttest	3.7193	4.6678	-15.467 ^S	26	.000

**S- Significant at $\alpha = .05$
(Negative t-values are due to the fact that posttest mean scores are larger than pretest mean scores)**

Conclusions

- The machine shop knowledge and skills among mechanical engineering students before the industry exposure were hardly developed in the academic institutions. This could be due to the absence of some machine shop and metal engineering facilities and equipment in the academic institutions. Other machines were already defective and were not properly maintained.
- The levels of development on shop knowledge and skills among mechanical engineering students after the industry exposure increased in all areas. This could be attributed to the hands on training in the industry especially to the presence of metal shop experts and the complete machine shop equipment.
- The Industry Exposure has an impact in the development of skills and knowledge and attitudes and habits among mechanical engineering students.
- The student trainees' attitudes and habits were already formed in the academic institutions but were still improved especially in the area of compliance to 5'S. The industry exposure still has an impact on their attitudes and habits.
- The level of development on attitudes and habits among mechanical engineering students after the industry exposure also increased. In some industries, student trainees were given the incentives and benefits such as working clothes, transportation allowance, and meal allowance which have motivated them.
- The impact on attitudes and habits of the student trainees was minimal because the same can be formed and learned in the schools. However, the level of their attitudes and habits were raised to the highest while they were in the industries.

- g. Not all four academic institutions which were included in the study have the same number of hours in their Industry Exposure or OJT. Besides, not all four academic institutions offer Industry Exposure or OJT as a requirement; however, regardless of number of hours, their knowledge and skills and attitudes and habits were still developed.

Suggestions

Taking the findings and conclusions into consideration, the researcher proposed the following recommendations:

- a. Industry exposure or OJT must be continued among engineering schools in Davao City because the study found out that the industry exposure was able to improve the knowledge and skills of students and elevated their levels. That the schools should enhance all the skills and knowledge that were mentioned in this study and as much as possible provide all the necessary laboratory equipment in the schools. The machines and metal equipment that were defective and non-functional should be regularly and properly checked for repairs and continuous maintenance. Establish a preventive maintenance program in the laboratory shops.
- b. Schools should increase the number of hour requirement of Industry Exposure Program. Moreover, the machine shop laboratory equipment in the schools should be upgraded.
- c. Schools should strengthen the industry-exposure program to maximize the development of the skills, knowledge, attitudes and habits of mechanical engineering students and to implement the 'Faculty Return to Industry' program for better immersion of faculty handling the course or subject. The faculty handling the subjects of Industry Exposure should be trained or re-trained in machine operations or should undergo upgrading to improve the students' knowledge and skills in the institutions. Schools should also institute plans for faculty and staff development.
- d. The way attitudes and habits are formed in the academic institutions be upheld. The culture of compliance to 5”S and International Standardization for Organization or ISO be imbibed in the academic institutions and its inclusion in the syllabi must be considered.
- e. Skills other than machine shop skills being developed in the schools be also given attention to equip or prepare them for actual employment.
- f. Schools should work hand in hand to make the Industry Exposure Program or on-the-job training (OJT) be an effective tool in the development of knowledge, skills, attitudes and habits. Schools should strengthen the linkage and collaboration between private agencies and government institutions (e.g. Mechanical Engineering Network (MEN), Philippine Society of Mechanical Engineers (PSME), Metalworking Industry Association of the Philippines (MIAP), Southern Mindanao Chamber of Metals Industries, Incorporated (SMCMII), Technical Panel for Engineering, Architecture and Maritime Education (TPEAME), local government offices (GO) and non-government organizations (NGO), etc.) to assist the enhancement of industrial training.

g. Industry exposure or on-the-job training or OJT must be a requirement in the mechanical engineering curriculum to ensure the development of student-trainees' knowledge and skills and attitudes and habits. Academic institutions should improve the classroom instruction and delivery system and adopt curriculum development. Revisions of the mechanical engineering curricula must be always considered to answer the demands and needs of industries.

References

- Baker, G. & Moore, K. (1983). *The critical link from plans to programs: New directions for community colleges*. San Francisco, USA: Josey Bass.
- Bittel, L.R. (1987). *The complete guide to supervisory training and development*. Reading, Massachusetts: Addison-Wesley Publishing Company, Inc.
- Camarao, F.C. (1991). *Technology education in the Philippines*: Philippines: National Bookstore 24K Printing Co.
- Dequito, R. L. (1988). Effecting a viable school-industry partnership: A U.S. approach for vocational and technical education. *The fruit bowl research and development journal*,(3), 2, pp. 17. Davao City: USP Publication.
- Dequito, R. L. 1988. Organizing the OJT program in technician institutes. *The fruit bowl research and development journal* (6), 1. Davao City: USP Publication.

A CROSS-NATIONAL ANALYSIS OF WHEN AND HOW VOCATIONAL EDUCATION IS OFFERED

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Abstract

Throughout history, hot debates have raged over whether or not to emphasise vocational education over general education at the secondary level. Different countries have different views on when and how vocational education is offered. Some offer vocational education as early as at 7th grade and others at 10th grade or even later. The way vocational education is offered, whether as elective courses in general schools or in different track as in separate institutions also varies from country to country. By using a case study of Southeast Asian countries and other countries in Europe and the Americas like Germany and the United States, this paper will discuss the pros and cons related to when is the best time to offer vocational education and how this type of education should be administered. Based on the common reasons used in the case study, the author concluded that economy is not the dominant factor influencing the policy and practices of when and how vocational education is offered, but rather due to the interactions of several factors including history, social, economic, and cultural background.

Keywords: vocational and technical education, education policies, trends, and issues

Introduction

The form of education that closely links or school/classroom instruction and work is commonly called vocational education. In a more specific definition, vocational education or workforce education is a form or model of education that teaches knowledge, skills, and attitudes geared to preparing students to enter the workplace. In formal education, vocational education is offered up to pre-baccalaureate level (Gray & Herr, 1997).

After examining vocational education as implemented in different countries in the world, it is clear that there is no uniform policy governing when and how vocational education is offered. Several countries start introducing vocational education as a separate program, not as an elective course as early as the 7th grade, while others start at 10th or even later at the postsecondary level. The way vocational education is offered, whether the vocational education is integrated into general education or separated from it, varies from country to country. There are reasons behind these choices. The country's history, socio-economic, and political conditions among others are some of salient factors that influence the choice.

This paper made use of case studies from Southeast Asian countries (Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam), Europe (France, Germany, United Kingdom), and American countries (Chili, Mexico, and the

United States) as illustrations. The selection of developed and developing countries is meant to compare and to contrast whether economic status has anything to do with the policy and practices of when and how vocational education is offered. Brief demographic and economic indicators of these countries can be seen in Table 1 and Table 2.

Table 1. *Demographic and Economic Indicators of the Southeast Asian Countries*

Variable	Country						
	Brunei	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Population	379,444	245,452,739	24,385,858	89,468,677	4,492,150	64,631,595	84,402,966
Literacy	93.9%	87.9%	88.7%	92.6%	92.5%	92.6%	90.3%
Below poverty line	NA	16.7% (2004)	8% (1998)	40% (2001)	NA	10% (2004)	19.5% (2004)
Employment sectors:							
* Agriculture	10% (1999)	46.5%	14.5%	36%	0%	49%	56.8%
* Industry	42%	11.8%	36%	16%	34%	14%	37%
* Services	48%	41.7% (1999)	49.5% (2000)	48% (2004)	76%	37% (2000)	6.2% (2005)
Unemployment	4.8% (2004)	10.9% (2005)	3.6% (2005)	12.2% (2005)	3.3% (2005)	1.4% (2005)	5.5% (2005)
GDP PPP	\$23,600 (2003)	\$3,700 (2005)	\$10,400 (2005)	\$5,100 (2005)	\$29,900 (2005)	\$8,300 (2005)	\$3,000 (2005)

Source: Central Intelligence Agency (2006)

By using the illustration of the selected countries, this paper will discuss the issue of vocational education by answering the following questions:

1. When is vocational education offered in countries in Southeast Asia, Europe, and the Americas? What are the salient reasons for offering vocational education at either 7th grade or earlier or at 10th grade or later? What are the pros and cons?
2. How is vocational education administered in those countries? Is it integrated with general education or separated? What are the salient reasons for either integrating vocational education with general education or separating them? What are the pros and cons on this issue?

Table 2. *Demographic and Economic Indicators of Selected European and American Countries*

Variable	Country					
	Chile	Mexico	U.S.A	France	Germany	UK
Population	16,134,219	245,452,739	24,385,858	89,468,677	4,492,150	64,631,595
Literacy	96.2%	87.9%	88.7%	92.6%	92.5%	92.6%
Below poverty line	18.2% (2005)	40% (2003)	12% (2004)	6.5% (2000)	NA	17% (2002)
Employment sectors:						
* Agriculture	13.6%	18%	2.4%	41%	2.8%	1.5%
* Industry	43.4%	24%	24.1%	24.4%	33.4%	19.1%
* Services	63%	58% (2003)	73.5%	71.5% (1999)	63.8% (1999)	79.5% (2004)
Unemployment	8% (2005)	3.6% + under employment	51.5% (2005)	10% (2005)	11.6% (2005)	4.7% (2005)
GDP PPP	\$11,300 (2005)	\$10,100 (2005)	\$42,000 (2005)	\$30,000 (2005)	\$29,800 (2005)	\$30,900 (2005)

Source: Central Intelligence Agency (2006)

Definition

Vocational education “traditionally refers to largely manual work training or machine-driven work training. It can range from assembly-line work procedures to operation of complex machines that perform highly specialized tasks. Vocational education is offered at all levels of education from high school to college” (Brewer, Campbell, & Petty, 2000, p.5).

In the U.S the term vocational education has been replaced with the term “career and technical education.” “Workforce education” and “vocational education” are also used interchangeably, but in a more limited context. Generally, workforce education refers to vocational education from secondary and pre-baccalaureate level and training in business and industry provided by employers (Gray & Herr, 1997). This paper will address only the formal type of education that is offered by educational institutions, such as secondary schools, community colleges, and polytechnics and other forms of postsecondary institutions that offer pre-baccalaureate degrees.

When is vocational education offered to students?

There is no agreement on when a school should start offering vocational programs. The policymakers who prefer to offer vocational programs earlier, 7th grade or lower, argue that since not all graduates from junior high schools continue their education to the higher level, it is wise to prepare them with some skills for entering labor market. The opposing argument to this approach is that tracking students too early may limit their options.

On the other hand, the policymakers who prefer to offer vocational education at later a time, 10th grade or later, argue that at the age of 16, someone is mature enough to decide or to choose which career he may pursue and his talent/strengths can be detected at this age. In addition, most graduates from senior high school are eligible to work, since their ages have reached a minimum age to work in some countries.

Table 3 below shows when vocational education is offered in different countries in Southeast Asia and several countries from the Americas and Europe. The Table shows that offering vocational education at earlier time is not only the choice of developing countries like the Philippines and Mexico, but also the choice of developed nations, such as Singapore and Germany. Similarly, the countries that prefer to offer vocational education later are also developing countries, such as Indonesia, Thailand, Vietnam, Malaysia, and Chile; and developed countries, such as France, the United Kingdom, and the United States. This finding defies the idea that the age at which vocational education is offered is related to the stage of the nation's development and, in particular, its economic development.

Table 3. *Grade at Which Vocational Education is Offered in Schools by Region*

Region	7 th Grade or earlier	7 th Grade or earlier	10 th	10 th Grade
	(Combined)	(Separated)	(Combined)	(Separated)
				Indonesia
Southeast Asia	Brunei Darussalam			Thailand
		Singapore	-	Vietnam
	Philippines			Malaysia
Europe	-	Germany	France	United Kingdom
Americas	-	Mexico	USA	Chili (9 th Grade)

Source: UNESCO, 2003

How is vocational program offered or administered?

Three common practices of offering or administering vocational education in secondary education are combined, separated, and multi-tracked. Combined practices mean that vocational education is offered under the same umbrella as general education; vocational education students are segregated from general or academic education, except when they are taking different classes. Vocational classes are offered as elective classes.

In separate practices, there is a clear division between vocational and general / academic streams. Vocational education is offered completely separate from general education, using different school buildings, and administered under different offices. The students from these two tracks are not in the same class or school building when they are in school. In the third practice, the multi-tracked, there are various types of pathways, whether as a narrow or rigid track, or in a more flexible form. The practices in selected countries are presented in Table 4.

Table 4. *The Scheme of How Vocational Education Is Offered in Schools by Region*

Region	Combined	Separated	Multi-tracked
Southeast Asia ^a	Brunei Darussalam	Indonesia	Singapore
	Philippines	Thailand	
		Vietnam	
		Malaysia	
Europe ^b	France	Germany	United Kingdom
Americas ^b	USA	Mexico	Chile

Source: ^aUNESCO, 2003; ^b Keating, Medrich, Volkoff, & Perry, 2002

The arguments about whether vocational education should be integrated or separated from general education can be traced back from European and American histories of adopting vocational education. According to Gray and Herr (1997), the separation of Vocational Education (VE) from General Education (GE) is consistent with capitalism in that it values efficiency, competition, meritocracy, and Darwin's theory of survival of the fittest.

Charles Prosser, the Secretary of the National Society for the promotion of Industrial Education elaborated on the idea of social efficiency by suggesting that the curriculum of VE should be offered separately from GE; this is commonly known as the dual system. At fourteen years of age, children are required to make an intelligent choice of occupation. Other scholars who believe that segregation between vocational and general education is necessary include Charles W. Eliot, the President of Harvard University, Edward C. Elliott, Professor of Education from the

University of Wisconsin-Madison, Edwin G. Cooley, the former superintendent of schools in Illinois. Charles W. Eliot strongly believes that sorting out students based on their talent or strength is necessary to help them cultivate their potential so that they will be successful in their life. He also argues that segregating students based on their potential is not undemocratic. Further he stated that doing otherwise is in fact against nature because everyone is different. (Gray and Herr, 1997)

John Dewey was one of the opponents of the dual system by arguing that this system is undemocratic and will tend to provide narrow job that eventually will limit students' opportunity. Dewey believes that VE is important for all students, not just for the poor. VE should be accessible to all students and should be integrated into general education. Integrating VE and GE will also avoid premature tracking and prevent children from making career decisions too early. In a democratic society, education should value egalitarianism, equity, common welfare, and relative equal distribution of wealth (Gray & Herr, 1997).

Segregating vocational from general education will harm all students, including those who decide to choose vocational education. Dewey argues that the segregation is wasteful and class-biased because it divides and duplicates educational facilities, weakens GE instead of strengthening it, and that those who are truly interested in VE will be disadvantaged due to low-image justification. The VE in dual system will tend to offer narrow occupational skills that should be the responsibility of the companies or industries. Public funds should be used to train students for citizenship or improve intelligence and character not for serving the purpose of employers (Lazerson & Grubb, 1974).

Mahatma Gandhi as cited in Weiner (1991) also proposed to integrate craft or productive work in basic education. The reasons are that the school will be able to self-finance or at least can pay the teachers and this will be a viable solution to introduce free and compulsory education. In addition, children can balance intellect with practice, or the mind and body. He also believes that this approach eventually will break down the existing barriers of prejudice between manual and intellectual workers. This type of basic education is meant for all social classes and not just for the poor.

The German dual system has been very successful in preparing a skilled workforce. Many countries have tried to adopt the German dual system, including China, France, United Kingdom, Singapore, Indonesia, South Korea, and many countries in Africa. Most of the effort to adopt the system failed due to their different socio-economic and historical backgrounds. Singapore is the only country that has successfully implemented the dual system (Wilson, 2000). The critiques against the German dual system are related to the early tracking and the rigidity of the program. The students have to make a career choice when they are still too young to decide, at 14 years old or even younger. Even though they can change back and forth between general and vocational, the process is cumbersome.

Theoretical framework.

The following theoretical frameworks will be used to analyze the current theory and practices of when and how vocational education is offered. The first theoretical framework contrasts vocational education with general education.

Educational systems, especially school systems, typically have a strong link with civil society, including the social structures and political system. Vocational education is frequently seen as an economic tool and is also frequently used as an instrument to counter structural unemployment. Therefore, vocational education, in comparison with general education, has weaker relations with civil society and national cultures. The possibility of having drastic change in training system is much higher than in general education system. Governments have shown willingness to adapt and to adopt vocational education programs and innovation from abroad (Keating et al., 2002).

The second theory is functional theory. According to functional theory, schools are expected to perform functions to maintain social equilibrium and are expected to adapt constantly to other systems. Foster's Ghana study as cited in Kazamias and Schartz (1997) states that: (a) different economic and occupational structure demands schools differently; (b) individual responses are based on which education will give the best reward; and (c) equilibrium should be maintained between schools and the economy. This does not automatically mean that when the economic condition changes, the education systems will change. But the fact that external factors, such as history, economic, and socio-political factors, will to some extent influence the educational theory and practices is inevitable and in most cases it is necessary, especially when policy makers are trying to adapt or to adopt educational practices from other countries.

The third theory looks at the philosophical roots of vocational education. The philosophy of vocational education or career and technical education can be one or the combination of two or three prominent factions: essentialist, pragmatist, or reconstructionist (Rojewski, 2002). While essentialists view vocational education as an education to meet labor market needs and the pragmatists view vocational education as fulfilling individual needs, reconstructionists view vocational education as transforming work into democratic learning organizations.

Analysis

There are various factors that influence the policy and practices of when and how vocational education is offered. Examining the practices from the selected countries and using the above theoretical frameworks, the author's hypothesis is that the country's practices are influenced by its economic and occupational structures and the way the policy makers dominantly view vocational education, whether essentialist, pragmatic, reconstructionist, or a combination.

Even though the findings are not conclusive, the stage of economy is an important factor that may affect the decision of delaying in offering vocational education. When the economy is better, educational participation at primary and junior secondary is usually higher. Consequently, offering vocational education at senior secondary becomes a viable option. Germany and Singapore are the exceptions; their history of a strong industrial economic base may be the cause of continually using the practice of offering VE at early time. Besides, vocational education in Germany is originally initiated by business and industry rather than by educational institutions.

Policymakers who dominantly follow essentialism are likely to agree to offer vocational education at 7th grade or sooner and prefer segregation or separated over combined or integrated vocational education. Meeting the standards of employers is the priority for these types of policymakers. In line with this thought, policymakers who dominantly follow constructivism are likely to agree to offer vocational education at later time, 10th grade or later, and prefer combined or integrated over segregation or separated system. The pragmatists will prefer a decision that can benefit the students the most. When unemployment is high and student participation in senior high school is low, they are likely to agree to offer vocational education at lower grade; otherwise they would prefer the choice of offering VE at higher grade. Since a combined or integrated model offers flexibility and more options to students, the pragmatists tend to prefer this approach over the segregation or separated model.

The other factor that may influence policy and practice of when vocational education is offered is from the recommendation by the World Bank. Recommendations are based on research conducted in the early 1960s. The research found that the lack of skilled-workers is not the only obstacle of economic growth. The findings also suggest that basic education offers higher returns and therefore should be prioritized, especially in developing countries (Psacharopoulos, 1985, p.24).

Conclusions and Remarks

Conclusions

Based on the case study of both developed and developing countries, the author concludes that despite the evidence of a strong relationship between vocational education and economy, including occupational structure, economy is not the dominant factor influencing the policy and practices of when and how vocational education is offered. In other words, the choice of when and how to offer vocational education is influenced by many factors, not only the economy, but also the interaction with and among other factors, including history, socio-cultural background, educational achievement of a country, the dominant views of the policymakers, and others.

The finding that the economic returns from VE in developing countries were not conclusive and that the lack of skilled workers is not the only obstacle to economic growth (Psacharopoulos, 1985) may have also influenced some developing countries' decisions to offer VE at later age. In 1990, Indonesia changed from a policy offering vocational education at the 7th grade to one offering it at 10th grade.

Remarks

Based on the pros and cons of the policy on when and how vocational education should be offered, I have several remarks to share as well. When a country has a good participation rate at senior high school (10th to 12th grade), offering

vocational education as a program at the 10th grade or later is recommended. If vocational education is offered as an elective class, it can be offered earlier, such in 4th grade. The preference of offering vocational education as a program at a later time is to avoid early tracking that is proven to limit student's options of their future careers.

Multi-tracking can be a good solution for compromising or bridging the dichotomy. In either case, whether vocational education is offered at the 7th or the 10th grade; using the integrated model over the separated one is also strongly recommended. The reasons are that the separated model or segregation is liable to eliminate social stratification; vocational education will end up enrolling students who are low performers or those who come from low socio-economic backgrounds.

References

- Brewer, E. W., Campbell, A. C., & Petty, G. C. (2000). *Foundations of workforce education. Historical, philosophical, and theoretical applications*. Dubuque, Iowa: Kendall/Hunt.
- Central Intelligence Agency. (2006, March 18). *The world factbook*. Retrieved April 4, 2006, from <http://www.cia.gov/cia/publications/factbook/index.html>
- Gray, K. C., & Herr, E. L. (1997). *Workforce education: The basics*. New York: Allyn & Bacon.
- Kazamias, A. M., & Schwartz, K. (1977). Intellectual and ideological perspectives in comparative education: An interpretation. *Comparative education review*, 21(2&3), 152-176.
- Keating, J., Medrich, E., Volkoff, V., & Perry, J. (2002). *Comparative study of vocational education and training systems: National vocational education and training systems across three regions under pressure of change*. Leabrook, Australia: National Centre for Vocational Education research.
- Lazerson, M., & Grubb, W. N. (Eds.). (1974). *American education and vocationalism*. New York: Teachers College Press.
- Psacharopoulos, G. (1985). *Education for development*. New York: Oxford University Press.
- Rojewski, J. W. (2002). Preparing the workforce of tomorrow: A conceptual framework for career and technical education. *Journal of Vocational Education Research*, 27(1), 7-34.
- UNESCO. (2003, November 17). *Educational system*. Retrieved April 14, 2004, from <http://www.unesco.org/iau/cd-data/>
- Weiner, M. (1991). *The child and the state in India*. Princeton, NJ: Princeton University Press.
- Wilson, D. N. (2000, March 8). *The German 'dual system' of occupational training: A much-replicated but oft-failed transfer*. Paper presented at the Paper delivered at the 2000 Annual Conference of The Comparative and International Education Society, San Antonio, Texas.

MULTI CHANNEL COMMUNICATION - A NEW LEARNING TECHNOLOGY

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Abstract

Multi-Channel Communication (MCC) is an adaptation of Guilford's research on the nature of human intelligence that emphasizes three types of intelligence: Figural, Symbolic, and Semantic. Research conducted at Motorola manufacturing facilities in Southeast Asia indicates that Semantic intelligence is of least strength and Symbolic and Figural intelligence are of most strength among manufacturing employees. Research results also indicate training materials designed using symbolic instructional design methods can: 1) reduce the actual training time of manufacturing operators by 50% (i.e., actual time away from work for non-OJT type training); and 2) increase learner retention of information by 800% when compared with results of a control group that did not receive MCC designed training. These research results suggest the traditional way of presenting instructional material in Semantic formats (that is, formats traditionally used by Australian, European, and North American educational systems) may actually be inappropriate for Southeast Asian populations because such material is not in alignment with the Symbolic and Figural learning strengths of Southeast Asian learners.

Keywords: multi-channel communication, learning technology

Background

Multi-Channel Communication (MCC) is an innovation in learning that has its theoretical foundation in the work of Guilford's *Structure of Intellect* (Guilford, 1967). MCC was initially developed and validated by Mary and Robert Meeker in collaboration with James R. Frasier when he was working as the Manager of Global Learning Research at Motorola University.

During World War II, the United States Army Air Corps was training airplane pilots, navigators and bombardiers. However, almost two out of every three men who entered pilot, navigator, and bombardier training did not complete their training -- *a 66% failure rate!* This was a very perplexing problem for the U.S. Army Air Corps. Unless a way could be found to dramatically increase the number of successful trainees, the U.S. Army Air Corps could not be a major contributor to the air defense of their ground forces.

In reviewing this training failure problem, the U.S. Army Air Corps found that the entrance requirements for the trainees seemed to be providing the very best training candidates available within the U.S. Army. Three criteria were being used in 1941 to select airplane pilots, navigators, and bombardier trainees: 1) excellent health and eye vision, 2) the ability to operate under stressful conditions, and 3) an Intelligence Quotient (IQ) of 120 or better.

To focus on the question of how best to determine whether a different measure of ability should be used to identify the best trainees, the U.S. Army Air Corps decided to enlist the expertise of J. P. Guilford who was serving in the U.S. Army as a staff psychologist. He had been experimenting in the mid-1930s at the University of Southern California with a new statistical technique that identifies clusters of related items; Factor Analysis. His idea was to construct a new type of paper-and-pencil test for selecting airplane pilot, navigator, and bombardier training candidates.

The test constructed by Guilford was not dependent on the person's Intelligence Quotient (IQ), but upon whether the person could pass a test that measured the abilities required of individuals who were to be airplane pilots, navigators, and bombardiers. To measure whether the test was valid, he administered the test to two groups; Group I were men that had successfully completed training, and Group II were men who had not successfully completed training. Using factor analysis to compare Group I and Group II test results, he was able to determine which paper-and-pencil test items could be used to construct a final test that would be used to identify the intellectual qualities needed by an individual in order to be a successful trainee.

The new test constructed by Guilford was a paradigm shift for those involved in constructing intelligence tests. What he was able to demonstrate for the U.S. Air Corps was a test that could be administered to potential trainees that had been able to reduce the previous failure rate of trainees from 66% to less than 5%. What he had demonstrated was that an Intelligence Quotient (IQ) test should not be used to determine who was intellectually ready to be trained as an airplane pilot, navigator, or bombardier. Indeed, what should be considered in determining a person's readiness for this type of war work should be a differentiated measure of intellectual abilities based on what is need to be successful at a given task or job.

After World War II, the United States Department of Defense continued to support Guilford's research on intelligence when he returned to the University of Southern California. From 1945-1965, Guilford's Aptitudes Research Project was able to identify 120 different factors of intelligence; 90 of which can be measured with statistically validated tests. His research was ultimately consolidated and became known as *The Structure of Intellect Theory*. Guilford's SOI Theory was first applied to education and training by Mary Meeker; and has since been distributed worldwide by the SOI Institute, Vida, Oregon, USA (Meeker, 1969).

The Structure of Intellect Theory

The Structure of Intellect (SOI) Theory identifies three major dimensions of intelligence: Content, Operations, and Product. Multi-Channel Communication is an Innovation of Guilford's *Content* dimension of intelligence. Guilford's SOI Theory identifies the Content of Intelligence to be of three types: *Figural, Symbolic, and Semantic*.

Figural content consists of images, shapes, simple sounds, gestalts, whole, concrete "things". Figural content has sensory character: visual, auditory, kinesthetic, and olfactory. Figural intelligence, then, deals with concrete information that one can see, hear, and touch directly.

Figural information is direct. The earliest languages were pictographic

– concrete representations of concepts. Asian languages such as Japanese and Mandarin are Figural-based languages.

Figural thinkers find it easy to read aerial maps by translating to the terrain what they have seen on the ground. Artists, mechanics, designers, civil engineers, architects, and craftsmen are high in Figural Intelligence.

Symbolic content is described by signs, letters, numbers, musical notations, and other code elements. For example, the alphabet and arithmetic number systems provide code elements that can be combined in endless ways, such as license plate numbers, telephone numbers, words, music, and statistics.

Symbolic intelligence deals with information in notational form. The two most common notational systems are alphabetic and numeric. Symbolic content is notational in character, designed for the recording and transmission of information.

People with strong Symbolic intelligence are excellent accountants, bookkeepers, file clerks, computer programmers, cryptanalysts, mathematicians, music transcribers, circuit designers, electrical engineers, and dance choreographers. When a person has weak symbolic intelligence they probably have difficulty with spelling and calculation.

Semantic content differs from Figural and Symbolic in that it refers to words, ideas and their abstract meanings. The word “tree” relates to your image of a tree; it has meaning and is thus semantic. Semantic content is abstract in that your idea of a tree may differ from another person’s idea and though each could communicate generally, there may also be areas of impreciseness.

Words and concepts are not exactly the same. The concept of “water” can be the same in any language, but the words would be different. Words representing the sounds of language are symbolic; words expressing ideas are semantic. A person who reads well but without comprehension can use the words to recreate the sounds of language, but cannot process the meanings that the words express.

Individuals who have strong Semantic intelligence like to write a novel or poem; can argue a case in court, like to handle public relations, enjoy preparing reports, can explain a point of view, like to negotiate, like to train others, and are good teachers.

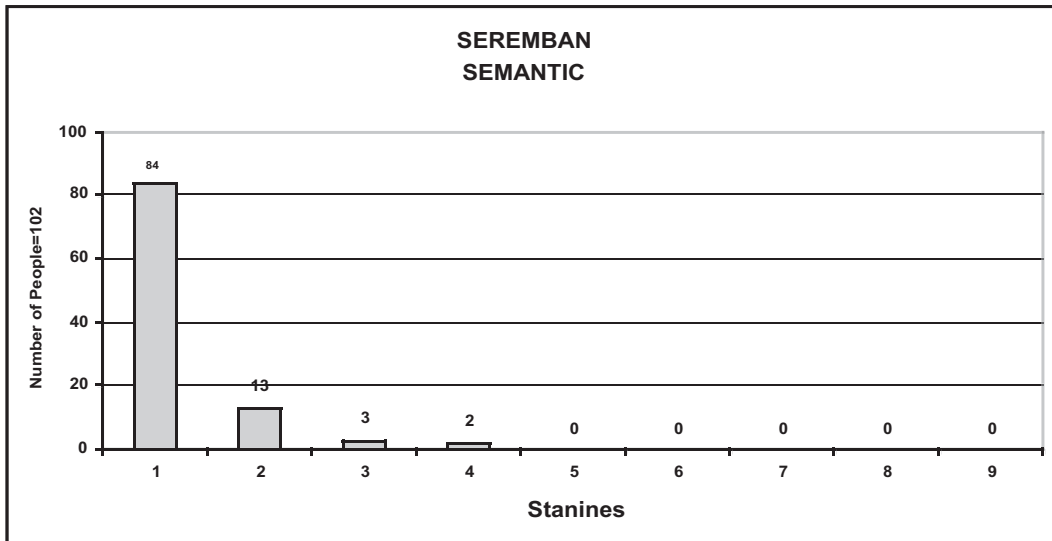
Semantic intelligence deals with concepts or ideas. That is, Semantic learners are very adept to easily processing the conceptual content of language. People who are not good at processing the conceptual content of language are at a disadvantage in much of education and training.

Multi-Channel Communication (MCC)

In 1995, Mary and Robert Meeker developed and validated a specially developed assessment: *SOI Form S*. They hypothesized that by administering this assessment to Motorola manufacturing operators, the dominant type of Content intelligence --- semantic, figural, symbolic could be identified. To validate the *SOI Form S*, Motorola University administered the Form to stratified random samples of 100 employees each at 10 manufacturing facilities located in the USA, Ireland, Mexico, Philippines, Singapore, and Malaysia.

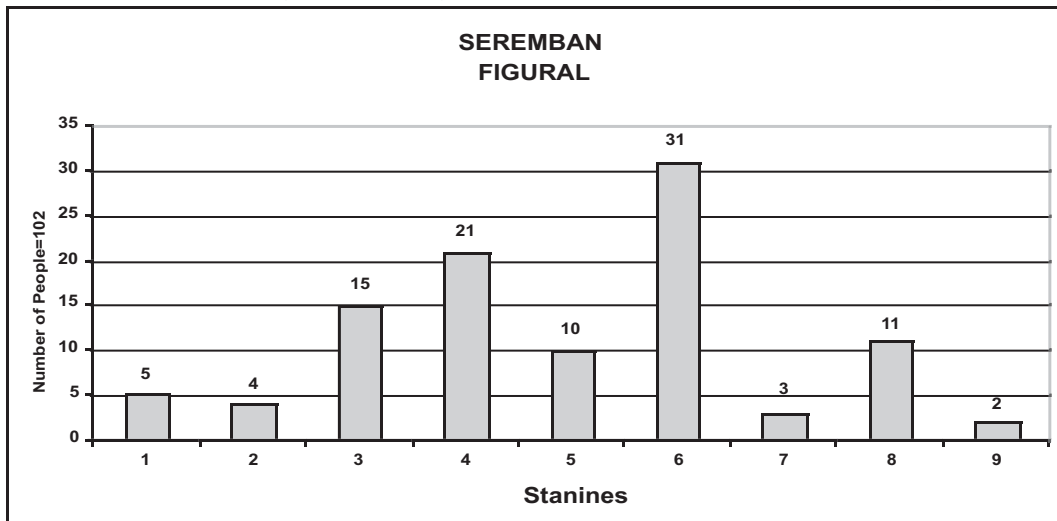
Results of the *SOI Form S* assessment at the 10 Motorola manufacturing facilities indicated that the Content intelligence of *least* strength across cultures was Semantic. For example, Table 1 on the next page summarizes the low semantic learning strength of Malaysian factory workers in Seremban, Malaysia. With a test result stanine of “1” (with 9 being highest), virtually all of the manufacturing operators would have a very difficult experience receiving training instructions given orally (person-to-person) or in semantic (written) formats.

Table 1. *SOI Form S Semantic Results for Seremban, Malaysia Manufacturing Operators*



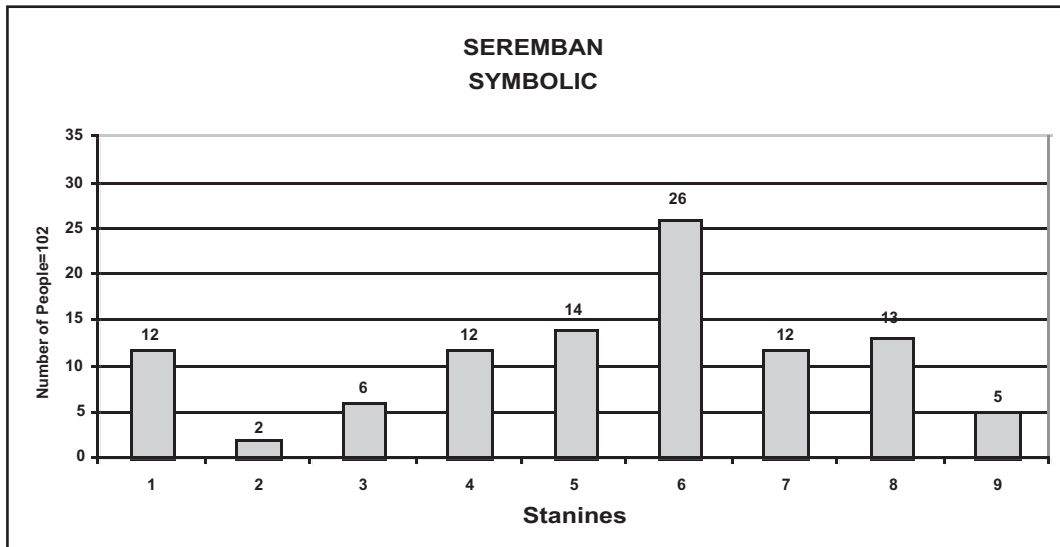
However, as shown in Table 2, the same manufacturing workers would have a much easier experience receiving training instructions when information is visual (like a picture) or than can be touched (like a model or exact replica of what is to be made).

Table 2. *SOI Form S Figural Results for Seremban, Malaysia Manufacturing Operators*



Perhaps even more encouraging, as shown in Table 3, the same manufacturing workers would have a very positive experience receiving training instructions when information is described by signs (such as icons on a computer screen) or symbols that represent a concept (such as ☺).

Table 3. *SOI Form S Symbolic Results for Seremban, Malaysia Manufacturing Operators*



Determining the Value of MCC

To assess the potential impact of this finding on employee learning, Motorola contracted Robert and Mary Meeker to re-engineer a training course using symbolic and figural formats for presenting course content. *Utilizing Six Steps to Six Sigma*, an eight-hour instructor-led training course delivered in multiple languages to all manufacturing workers worldwide, was selected for the project. The result of their re-engineering project was a 4-hour, same content, same learning outcomes, instructor-led training course. They named this training course re-engineering method *Multi-Channel Communication (MCC)*.

To measure the strength of the MCC method, Motorola University designed study with randomly assigned control and experimental groups to compare the learning retention of manufacturing workers who attended the standard Semantic training program and the MCC Symbolic and Figural constructed training program. Two groups of 100 manufacturing employees were selected as determined by gender, age and length of schooling. The training was conducted on opposite shifts; 25 employees per class session.

Each group was tested using the same questions; semantic constructed questions for the standard Semantic dominated training program, MCC Symbolic and Figural constructed questions for the other group. To determine learning retention over time, unannounced tests were administered to employees at 30 and 90 day intervals from the date of the training course delivery.

After 30 days from receiving instruction, the highest test score of those receiving the Semantic training course was 16 correct out of 20 questions; four individuals out of 100 scored 16 correct. In the MCC training that used Symbolic and Figural construction of learning materials, 83 individuals scored 16 or more correct out of 20 questions.

After 90 days from receiving instruction, the highest score of those receiving the Semantic training course was 14 correct out of 20 questions; only one individual out of 100 scored 14 correct. In the MCC training course that used Symbolic and Figural construction of learning materials, 80 individuals scored 14 or more correct out of 20 questions.

In summary, the MCC instructional design methodology reduced the training time of manufacturing operators by 50% (i.e., actual time away from work for non-OJT type training) and increased learning retention by 800% at 30-day and 90-day post training follow-up testing sessions.

Implications for Training Professionals

The most immediate implication worthy of consideration is that actual training time of manufacturing operators can be reduced by 50% using the MCC method. Time is money to manufacturing managers; half-less-time away from work for training is at least a cost reduction of 50% to the bottom line of worker productivity measures.

Another implication is that the traditional way of presenting training materials in Semantic formats (that is, formats traditionally used by European and North American educational systems) within non-western cultures may actually be inappropriate because the training is being constructed and/or presented in ways that are not in alignment with the strengths of Symbolic and Figural intelligence prominent in non-western countries. Indeed, the MCC method of instructional design calls out for further investigation by vocational education and training professionals in Asian countries where the education systems have been traditionally influenced by western approaches to learning and training.

Additionally, the implications for development of multi-media products for web, CD ROM, and other mediums are many. At present, almost all multi-media design efforts are Semantic dominated in their architecture and format.

References

- Frasier, J. R. (1995). *First Motorola Worldwide Learning, Training and Education Evaluation and Research Conference: Selected Papers*. Schaumburg, IL: Motorola University Press.
- Frasier, James R. (December 1997). *Multi-Channel Communication Reduces Manufacturing Employee Training Time by 50%*. Asian Trainers' Convention. Penang, Malaysia.
- Guilford, J. P. (1967). *The Nature of Human Intelligence*. New York: McGraw-Hill.
- Meeker, M. N. (1969). *The Structure of Intellect: Its Interpretation and Uses*. Columbus, OH: Merrill Publishing.

HAVE SCHOOL VET PROGRAMS BEEN SUCCESSFUL?

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Australia

Abstract

The introduction of Australian school VET programs to provide more diverse pathways to work and further study for young people has been successful in terms of participation. Since the inception of school VET programs in Australia in 1996, there has been a rapid uptake to the extent that, in 2004, around half of all Australian secondary students participated in school VET programs, predominantly in Years 11 and 12. However, this research finding suggests that for students who participated in Australian school VET programs in 2000, the proportion of students with successful outcomes was not uniform. In this research, 'success' is defined, firstly, in the school context as retention to Year 12, and secondly, outside the school context in terms of full-time engagement with employment or learning, or part-time study combined with part-time work. Overall, this research found that school VET programs have not led to a significant increase in Year 12 retention. Participation in school VET programs has a small positive impact on retention from Year 10 to Year 11 but this is offset by a negative effect on Year 11 to Year 12 retention. We found a positive impact on post-school outcomes for students who participated in school VET programs in Year 11, but did not go on to complete Year 12. These gains were more sizeable for girls than boys, but over time this positive effect was diluted for both genders. School VET programs provide a clear post-school VET pathway for some students, particularly for boys studying in the areas of building and engineering. However, for most students, the pathway was not so direct. For most students, there was a poor alignment between the types of VET programs studied at school and the requirements of work or further study.

Keywords: Vocational technical education, student outcomes, pathways, post-school outcomes, student retention, Australia

For full details of the study, including more detailed statistical appendices, please refer to <http://www.ncver.edu.au/publications/1654.html>.

Introduction

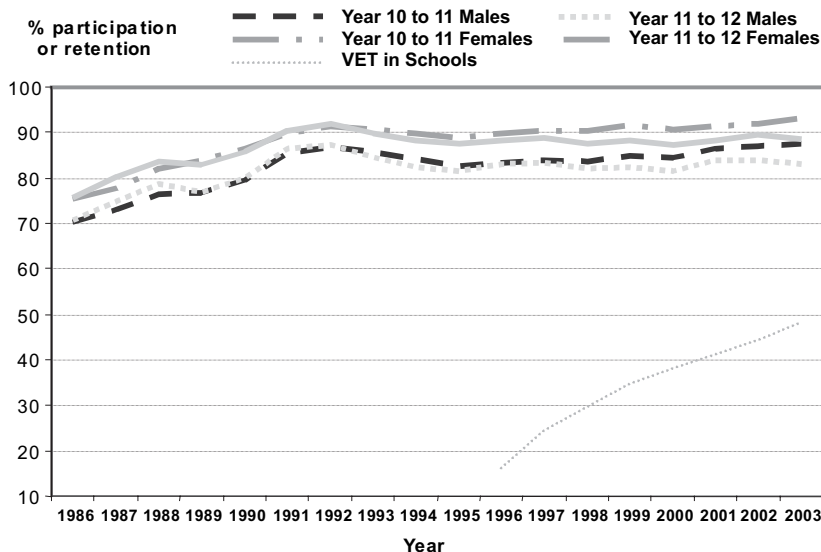
School vocational education and training (VET) programs have a range of definitions. What is commonly referred to as *VET in Schools* is where school students undertake recognised VET as part of the senior secondary certificate. These students attain a VET qualification, or part thereof, and the senior secondary certificate. However, it is not a single option because under the *VET in Schools* arrangements, students can undertake VET subjects or VET courses or school-based

New Apprenticeships. This is further complicated because students who undertake VET subjects or courses as part of the senior secondary certificate may or may not include a structured workplace learning component (Woods, 2005).

School VET programs are usually offered to students in Years 11 and 12, but some are offered in Year 10. There are widespread differences across the various states and territories in the delivery of these programs, and the range offered. New versions of traditional school curricula, specifically information technology, hospitality and office administration remain the most popular subject areas studied (Polesel et. al. 2004), accounting for half of all school VET enrolments (Malley et al, 2001b). However, particularly in regional areas, more locally relevant school VET programs are also offered. These include Certificate I & II in Seafood Industry in aquaculture areas, and Certification I & II in Food Processing (wine) in wine-producing regions across Australia.

The introduction of *VET in Schools* is a significant change to post-compulsory schooling. While vocational subjects had been introduced by schools prior to this, they did not lead to recognised VET qualifications. The *VET in Schools* program, as adopted by the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) in the mid 1990's incorporated vocational subjects which led to recognised Australian Qualifications Framework certificates while counting towards the various state senior secondary certificates.

Figure 1. Year 10 to Year 11 and Year 11 to Year 12 apparent retention rates and VET in Schools Participation, 1986-2003



Source: ABS Schools Australia, 4221.0 various years, MCEETYA transition from Schools Taskforce (2004)

For students, the attractiveness of school VET programs is that they provide an alternative to the traditional pathway to university. Some students take VET subjects as part of their secondary school certificate, while others are less engaged

with school VET programs, using them as a ‘taster’ of VET. As noted by Polesel et al. (2004), a number of students are simply unable to participate more fully in these programs because of limitations on provision, while others choose not to participate in school VET programs because VET does not fit their academic trajectory.

School VET programs are certainly popular among Year 11 and 12 secondary school students. Since their introduction in 1996, when 16% of senior secondary school students participated in these programs, their popularity has grown to almost 50% in 2003 (Figure 1). The number of schools offering these programs is large, with over 95% of senior secondary schools offering school VET programs in 2003 (MCEETYA, 2004).

Research questions

The main research question addressed in this paper was whether school VET programs had been successful or not in offering attractive programs to the students. Particularly, the research was focused on three aspects:

- Year 12 retention (and its vocational equivalent)
- Successful post-school outcomes (or transitions to work and/further study)
- Post-school VET pathways.

If school VET programs are achieving their role in making school more attractive for those with more diverse needs and different learning styles, then we would hope to see increased school retention. Similarly, if school VET programs are achieving their role in enhancing post-school transition, and providing more diverse pathways from school to work and/or study, then we should be able to see that participation in these programs leads to successful post-school outcomes. By successful post-school outcomes we mean post-school full-time engagement with work and learning, or their combined full-time equivalent.

Methodology

To provide context, we first looked at the characteristics of students who acknowledged that they participated in school VET programs in Year 11. We then measured the success of students who did and did not participate in school VET programs. Success was measured at school by examining the retention to Year 12 (or its vocational equivalent), and after school as measured by looking at the engagement with employment or learning. Finally, we examined the post-school VET pathways of the cohort, comparing them with students of equivalent age in the public VET system.

Our research was focused on a cohort of students from the Longitudinal Surveys of Australian Youth (LSAY), following them from Year 9 in 1998 through to 2002, one year out from Year 12 for the majority of students. During this time frame we had a relatively buoyant labour market, which has historically encouraged early school leaving and falling school retention rates. For our analysis on post-

school pathways, we also used the National VET Provider Collection, which we matched with the LSAY data.

The demographic variables used in our predictive model were those that had been identified in previous research as being indicative of participation in school VET programs. We also looked for other factors, such as a student's attitude to school and their peers. We did consider using a variable that indicated whether or not a student received and read information on VET at school, but as this was not asked until Year 11, it was signalling actual VET participation rather than adding to the predictive power of the model.

The final probability of a student participating in school VET programs in Year 11 was based on the following set of variables:

- Demographic variables - gender, school type, state where attended school, ethnicity, area of residence, parental occupation and education background, and a student's academic score.
- Attitudinal variables – self-perceived ability (composite variable derived from student self-perceived rating of ability in English, mathematics, science, language other than English and studies of society and the environment), perceived attitude of peers (composite variable derived from student perceived rating of their peers' ability to make good progress, eagerness to learn, working hard and being well behaved), student's own aspirations (intend to do Year 12 or not as asked while still in Year 10) and engagement with school (composite variable derived from student participation in extracurricular drama, sport, debating, music activities and volunteering).

Statistical approach to the evaluation of the impact of school VET programs on school retention

For school retention, we modelled the probability that a student continued from Year 10 to Year 11, and Year 11 to Year 12 in separate logistic regression equations. The variables for this model were the same as those used for the predicted probability of school VET participation (outlined above), including whether or not a student participated in school VET programs. Separate models were run for boys and girls.

The difficulty we had to overcome in this modelling was that school VET programs were only offered in Year 11, so it was impossible to measure the impact of these programs on Year 10 to Year 11 retention for those students who did not make it to Year 11. To overcome this problem, we used a variable defined as 'VET dosage', derived by calculating school VET participation for a given school, then applying this to each student.

Finally, we used a 'mind experiment', where we started with students who were in Year 11, and projected back to calculate the number who would have come from Year 10 by whether or not they participated in school VET programs, and forward to Year 12, again by whether or not they participated in school VET programs. The purpose of this exercise was to assess the overall impact of school VET on the cohort. In this 'mind experiment', we were able to utilise our retention models, and by setting school VET participation as zero, we calculated the counterfactual.

Statistical approach to the evaluation of the impact of school VET programs on the transition to work and further study

For transition to work and further study we modelled whether or not a student would continue on from school into full-time work or further study (or the full-time equivalent) using the same variables including the VET participation variable in a logistic regression model with the dependent variable being a successful post-school outcome. We repeated the modelling for students who left school in Years 10, 11 and 12, to assess the impact of school VET program on early leavers and those who completed school to Year 12. Separate models were run for boys and girls.

Statistical approach to the evaluation of the impact of school VET programs on post-school pathway

In evaluating the impact of school VET programs on post-school pathways, we first observed the proportions of students going on to post-school VET, segmented by gender and whether or not they had participated in school VET programs.

To complement this analysis, we used data from the National VET Provider Collection which contains information on Australian public VET students, including VET in Schools students. We used this data to compare the types of subjects studied in school VET programs with those studied by students of comparable age outside the school VET system.

Finally, using a sub-sample of the LSAY data we matched to the National VET Provider Collection to see whether or not students continued on with their school VET subjects. We determined whether the proportions studying the school VET subjects were significantly greater than those we would expect to see by chance. We analysed the effect for boys and for girls separately.

Findings

Do school students self select into VET school programs?

We know at the outset that there was extensive research on the characteristics of school VET students, including being of lower academic ability, from parents with lower education levels, and attending a government school. Our analysis confirms this, but we also found that a student's self-perceived academic ability is as good an indicator of propensity to participate in school VET programs as is actual assessed academic ability. This is important because we know that students self-select into school VET programs because they see these programs as providing a better match with their perceived academic ability. However, we did not find that a student's perception of their peers related to their propensity to participate in school VET programs, which is noteworthy given the importance placed on peer group pressure.

Do school VET programs improve school retention?

In looking at retention, we found a positive effect from participation in school VET programs on retention from Year 10 to 11, but a negative effect on retention from Year 11 to 12. These effects are after controlling for a wide range of personal

characteristics, including academic ability and socio-economic characteristics. The effects are larger for boys than for girls. Including the vocational equivalent to Year 12 does not materially change the result.

Table 1. *School VET Participation and Modelled Retention*

School VET participation	Boys (%)			Girls (%)		
	Year 10 -Year 11	Year 11 -Year 12	Year 10 -Year 12	Year 10 -Year 11	Year 11 -Year 12	Year 10 -Year 12
Participated in school VET	94.4	85.5	80.7	96.8	90.7	87.8
Counterfactual (no school VET)	93.0	88.8	82.5	96.0	92.0	88.4
Impact of school VET on participants	+1.4	-3.3	-1.8	+0.8	-1.3	-0.6
Impact on all students	+0.4	-0.9	-0.5	+0.2	-0.3	-0.2

Taking the results together, our model indicates that there is an effect of school VET on retention. Overall, there was a decrease in Year 10 to Year 12 retention of -0.5 percentage points for boys or -0.4 percentage points if looking at Year 12 vocational equivalent and virtually no change for girls.

Do school VET programs assist students in their transition from school to work or further study?

We found that for school VET students who leave school after Year 11, their transition was certainly smoother than those who did not participate in school VET programs, but that the gain was soon diminished over time (table 2). For students who completed Year 12, we found no benefit from participation in school VET programs; in fact we observed a slightly negative effect. We also found from Table 2 that it is not an easy road to success for those who quit school after Year 10 with many spending considerable time out of the labour market.

Table 2. *Predicted Probabilities of Successful Outcomes by Gender and Highest School Level Completed, 2000-2002*

Highest school level completed	Boys		diff	Girls		diff
	School VET	No School-VET		School VET	No school VET	
2002						
Year 12	88.1%	90.2%	-2.1%	87.9%	88.9%	-1.0%
Year 11	91.4%	88.6%	+2.8%	83.6%	78.4%	+5.2%
Year 10	-	92.4%		-	81.3%	
2001						
Year 11	78.9%	67.6%	+11.3%	63.7%	48.9%	+14.8%
Year 10	-	76.2%		-	55.0%	
2000						
Year 10	-	68.0%		-	46.7%	

Do school VET programs provide post-school VET pathways?

School VET is by no means the only pathway into post-school VET. We found as much post-school VET activity amongst students who leave school before they have an opportunity to participate in these programs as we do amongst school VET students. However, the transition into post-school VET is not as smooth for these early school leavers. Post-school outcomes by highest year of school and school VET participation are presented in Table 3.

Table 3. *Post-School Pathways in 2002 by Highest School Level Completed and School VET Participation*

Pathways in 2002	Year 12 ¹		Year 11 ²		Year 10 ³
	School VET	No school VET	School VET	No school VET	No school VET
Girls	n=766	n=2,574	n=81	n=155	n=231
TAFE	27.5%	14.2%	27.2%	23.2%	23.4%
Apprenticeship/Traineeship	14.5%	7.3%	25.9%	23.9%	31.6%
Total post-school VET for girls	42.0%	21.5%	53.1%	47.1%	55.0%
Boys	n=658	n=2286	n=146	n=175	n=252
TAFE	22.0%	14.8%	14.4%	20.0%	12.3%
Apprenticeship/Traineeship	21.4%	10.9%	54.1%	37.7%	56.0%
Total post-school VET for boys	43.4%	25.7%	68.5%	57.7%	68.3%

¹One year post-school, ²Two years post school, ³Three years post school

Turning to the analysis of data from the National VET Provider Collection, we found equal proportions of boys and girls participating in school VET programs. However, when we matched the LSAY students with this larger collection we found that for girls there is little evidence of post-school continuation with school VET subjects, unlike for boys where we found continuation for those studying engineering and building type courses (Table 4).

This suggests that girls were using school VET as a ‘taster’, or for immediate employment outcomes rather than for longer-term post-school pathways. Indeed for many students, school VET might be broadening their options to the extent that they were using VET to eliminate what they did not want to do post-school, rather than directing them into post-school pathways.

In looking at the types of school VET programs, we found that the fields of education delivered in school VET did not line up particularly well with VET offered outside school (that are more likely to reflect labour market demands), and as noted above girls tended to shy away from the VET subjects they studied at school.

Table 4. *Course Information in 2003 for a Range of VET Students from The National VET Provider Collection*

Field of education	Boys			Girls		
	16-17 yrs, school VET	16-17 yrs, non-school VET	18-19 yrs, Post-school VET	16-17 yrs, school VET	16-17 yrs, non-school VET	18-19 yrs, Post-school VET
	(n=59,235)	(n=72,544)	(n=108,774)	(n=58,739)	(n=58,827)	(n=87,568)
Natural & phy. sciences	0.0%	0.2%	0.4%	0.1%	0.3%	0.8%
Information technology	24.4%	6.9%	7.4%	10.8%	2.7%	2.0%
Engineering & rel. tech.	18.6%	30.6%	31.6%	2.2%	2.8%	3.3%
Architecture & building	10.2%	13.1%	13.4%	0.3%	0.5%	1.2%
Agriculture, environment & related studies	4.3%	6.7%	5.3%	3.0%	3.3%	2.0%
Health	0.1%	2.3%	2.0%	0.6%	2.2%	4.0%
Education	0.2%	0.7%	0.2%	0.1%	1.8%	0.6%
Management & commerce	15.8%	10.0%	14.2%	32.8%	29.8%	37.5%
Society & culture	3.9%	3.5%	3.9%	9.3%	12.7%	15.6%
Creative arts	4.1%	2.8%	3.5%	4.0%	4.6%	5.1%
Food, hospitality & personal services	12.0%	9.8%	10.2%	31.0%	24.1%	18.1%
Mixed field programmes	6.3%	12.3%	6.9%	5.7%	13.5%	8.5%
Subject only	0.0%	1.2%	0.8%	0.0%	1.8%	1.4%
Qualification Level	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Diploma or higher	0.0%	2.7%	15.4%	0.0%	3.5%	20.6%
Certificate IV	0.3%	3.0%	9.5%	0.3%	3.4%	11.5%
Certificate III	8.1%	30.6%	42.4%	9.3%	26.6%	31.5%
Certificate II	61.2%	32.5%	15.0%	73.3%	44.0%	18.8%
Certificate I	23.6%	14.3%	4.1%	11.6%	5.8%	2.5%
Secondary education	0.0%	1.2%	1.1%	0.0%	1.9%	1.6%
Non award courses	0.4%	3.2%	3.0%	0.2%	2.8%	2.8%
Other education	6.4%	11.3%	8.7%	5.3%	10.2%	9.2%
Subject only - no qualification	0.0%	1.2%	0.8%	0.0%	1.8%	1.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

In comparing VET offerings inside and outside school one note of discord is that school VET is studied at a lower level, even for the same age groups. Certificate III is the bread and butter of the VET world and there are very few of these offered at school. There may be good reasons for this; for example, schools may not have ready access to appropriate infrastructure and trainers. In comparing VET offerings inside and outside school one note of discord is that school VET is studied at a lower level, even for the same age groups. Certificate III is the bread and butter of the VET world and there are very few of these offered at school. There may be good reasons for this; for example, schools may not have ready access to appropriate infrastructure and trainers.

Conclusion

In this paper we set out to answer the seemingly simple question: *Have school VET programs been successful?* In unpacking this question, we looked at outcomes in terms of retention to Year 12, and post-school engagement with learning and employment. Finally, we looked at whether school VET programs are establishing post-school VET pathways.

In broad terms, our main findings are:

VET delivered at school has grown enormously, to the extent that around half of Year 11 and Year 12 students have some exposure to it. VET at school tends to be attractive to those who are less academically inclined, and who are more inclined to continue with VET after school. However, it is by no means the only pathway into post-school VET. Indeed, those who leave after Year 10 end up doing as much post-school VET as those who undertook VET at school.

Our analysis indicates a positive effect on Year 10 to Year 11 retention, but a negative effect on Year 11 to Year 12 retention. The effects are larger for boys than girls. Overall, we estimate a small negative effect on Year 12 retention, although the size of the effect is of no policy significance. Repeating the analysis including the vocational equivalent to Year 12 does not materially alter the conclusion.

However, students who leave after Year 11 have much better outcomes the next year compared to Year 11 leavers who had not done VET. This suggests that the reason for the negative effect on Year 11 to Year 12 school retention is tied up with the VET program aiding the transition to the labour market, perhaps through the work experience component of the program. VET in school does not appear to assist those who complete Year 12, at least in terms of the proportion in subsequent study or employment.

A simple comparison of what students are doing in 'Year 13' indicates that early school leavers are not that badly off when success is defined in both labour market and study terms. However, those who leave early have a much tougher ride and the transition process is much longer than for those who stay to Year 12. As noted above, those who leave after Year 11 clearly benefit from their VET in school program. It must also be kept in mind that the cohort studied had the benefit of a reasonably buoyant labour market.

Policy Implications

It is beyond the purpose of this paper to spell out policy implications. However, the paper does raise some questions worth addressing:

- ◆ Is the focus of school VET programs in Years 11 and 12 appropriate given that many early school leavers do not get to Year 11, and the evidence is that it does not assist Year 11 to Year 12 retention?
- ◆ Do we need to distinguish between those students who are genuinely looking for a VET pathway and those who may have a passing interest in VET? Perhaps the administrative data on numbers undertaking VET at school are not particularly informative since both groups are lumped together.
- ◆ Do school VET programs need to focus more seriously on a VET pathway with a clear labour market aim? That is, do school VET offerings need to be better aligned with those offered outside school, in both field and level, and should more attention be paid to employment prospects rather thinking about school VET programs within its educational setting. Are there other educational settings that could be integrated into the schooling framework?
- ◆ Alternatively, given that school VET does not provide a clear vocational pathway for many VET inclined students, would it be better to downplay the industrial strength aspects of VET at school (such as the emphasis on industry competencies and AQF certificates) and emphasise broader vocational education skills? That is, perhaps we should consider school VET more as pre-vocational preparation. This would certainly lend itself to the school setting.

References

- Anlezark, A., Karmel, T., & Ong, K. (2006). *Have school VET programs been successful?* National Centre for Vocational Education Research, Adelaide. Accessed at <http://www.ncver.edu.au/publications/1654.html>.
- Australian Bureau of Statistics. (2002). *Australian Schools*, 4221.0, ABS, Canberra.
- Malley, J., Keating, J., Robinson, G. (2001b). *The Quest for a Working Blueprint: VET in Australian Schools*, vol 2. NCVET, Adelaide.
- Ministerial Council on Education, Employment, Training and Youth Affairs MCEETYA. (2004). *National Data on Participation in VET in Schools Programs & School-based New Apprenticeships for the 2003 School Year*. Australia.
- Polesel, J., Helme, S., Davies, M., Teese, R., Nicholas, T., & Vickers, M. (2004). *VET in Schools: A post-compulsory education perspective*. NCVET, Adelaide.
- Woods, D. (2005). *Young people and vocational education and training options: At a glance*. NCVET, Adelaide.

CENTRE-PERIPHERY MODELS: A STRATEGY FOR CURRICULUM INNOVATION IN BRUNEI DARUSSALAM

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Abstract

In many countries around the world, the strategy in designing curriculum or making changes in an existing one matters. This is often seen as the job of the curriculum experts acting through ministries of education. Teachers in schools and colleges are mere passive receivers of whatever is provided to them from the centre. The assumption in this paper is that the strategy used in effecting changes in the curriculum in Brunei Darussalam corresponds to the Centre–Periphery (C–P) model. This paper described two very well-known models of curriculum reform, namely Donald Schon’s Centre–Periphery model and Havelock’s Research, Development and Diffusion (R, D&D) model, which have been used in the United States of America and in the United Kingdom for many decades. It also looked at another process called the DACUM; an acronym for “Developing A Curriculum” which was first developed as a joint effort by the Canadian Department of Manpower and Immigration and the General Learning Corporation, and later adopted by the Nova Scotia New Start, Incorporation which utilized the strategy for the determination of vocational curriculum content for disadvantaged adult learners as stated by Finch & Crunkilton in 1999. In recent years some states in the US such as Ohio and Virginia are said to have adapted the process. The Programme Development Section of the Department of Technical Education, Brunei Darussalam is currently using the same approach in the development of its competency - based education and training programmes. This paper also examined the relevance and effectiveness of the models and processes in the Brunei Darussalam context and made suggestions for their optimal use.

Keywords: curriculum, centre-periphery models, Brunei Darussalam

Introduction

The world we live in today is different in many ways from the one we were born into and is expected to be different from the one to come in the future. From time to time human beings experience social, political, economic, religious or technological changes which shape and reshape ways in which they live and relate to one another. In the opening chapter of the book by Schon (1971, p.30) said he stated: “The loss of stable state means that our society and all its institutions are in continuing process of transformation. We cannot expect new stable states that will endure for our own lifetime.”

Some people may be tempted to resist and prevent change from ever taking place in their organizations. Such extreme view is not in the best interest of anybody.

People need change to grow and prosper, and without it, they stagnate and die.

School curriculum is not spared from the process of transformation. Indeed, more changes occur in what teachers and learners do in classrooms than in any other part of society. There are many factors which are responsible for changes in the curriculum. The most important of which is the increasing number of learners from different social, economic backgrounds who bring to the education system their varying needs and aspirations. Another factor concerns differences of the real meaning of education between learners, parents, teachers and education decision-makers, which often make changes in school curriculum inevitable. Periodic reforms in the curriculum are sometimes dictated by changes in technology and the need to keep abreast with modern techniques and practices. Curriculum modifications may be necessitated by sheer desire to improve the quality of teaching and learning in schools. Innovation is indeed the live wire of schools and colleges and their curricula. Malcolm Skilbeck once said that education and curriculum improvements are the means of survival in a rapidly changing environment. "Without innovation", Malcolm argued, "our schools will be like the dinosaur, unable to survive because it was unable to adapt" (Cited in Open University, 1976, p.12). "Teachers and other curriculum stakeholders should learn to understand, guide, influence and manage curriculum innovations and make such understanding integral to themselves and their schools," Schon (1971, p.30) advised. "We must able not only to transform our institutions, in response to changing situations and requirements; we must also invent and develop institutions which are learning systems, that is to say, systems capable of bringing about their own continuing transformations."

Purpose

This paper described some of the well-known models of curriculum innovation and suggested some modifications to make them more relevant and effective reform strategies in the Brunei Darussalam context. The paper also looked at the suitability in the Brunei education environment, of the **DACUM** process which is now being adapted by the Programme Development Section of the Department of Technical Education (DTE-BD) Brunei Darussalam in the development of its competency-based education and training programmes.

Clarification of Terminologies

Before embarking on detailed discussions of the various approaches of effecting reforms in curriculum documents, the reader is reminded not to confuse the term model with phase or level of curriculum innovation. The terms are not completely different; indeed, they are complementary to each other as they will become evident later in this paper. Broadly, 'model' refers to the overall plan of an innovation and phase or level concerns specific activities required to successfully implement a model. One often finds that phases designed specifically for a particular model may be applied to other models as well but not necessarily equally (Ruddock & Kelly, 1976).

Methodology

Information presented and discussed in this paper was collected mainly from secondary sources, namely the open literature and official documentations of the DTE - BD. Discussions made and suggestions offered in this study were derived from the author's personal experience as a curriculum developer in the area of vocational and technical education.

Limitations

The present study was largely descriptive and it focused mainly on the process of modifying existing curriculum. The design of new curriculum document was not given the consideration it deserved. This is perhaps the greatest limitation of the study. Again, the review of only two major models of curriculum innovation does not provide enough options to readers and education decision-makers.

Curriculum Innovation, “bandwagon or hearse”?

The rate and relative ease at which new ideas find their ways into education systems in many countries around the world makes one wonder whether such ideas were always deemed necessary in the first place or they were simply introduced by decision-makers for political and other personal reasons. Taba (1962) in her widely quoted book described the situation in the following manner:

Decisions leading to change in the curriculum organization have been made largely by pressure, by hunches, or in terms of expediency instead of being based on clear-cut theoretical considerations or tested knowledge. The scope of curriculum has been extended vastly without an adequate consideration of the consequence of this extension on sequence or cumulative learning.... The fact that these perplexities underlying curriculum change have not been studied adequately may account for the proliferation of approaches to curriculum making (p.9).

Commenting on the catalogue of reforms in schools in England and Wales in the 1970s, Nisbet (1975) noted that innovation had become something of a “bandwagon”, that is, “something cheap, meretricious and gimmicky, undertaken rashly without careful planning and adequate resources to see it through, as a protest arising out of frustration and impatience” (p.1). These comments are not aimed at discouraging well-articulated and genuine attempts at educational improvement. As mentioned earlier in this paper, innovation is indeed one of the means of survival of all educational systems in a rapidly changing world. But change in education should always be undertaken with great care and caution so that it does not become a burden and an impediment to the system it is designed to improve.

Function of Models in the Curriculum Innovation Process

In many education systems there seems to be no shortages of new ideas. Teachers in educational institutions are often overwhelmed by the sheer numbers and rate at which new ideas find their way into the systems. The problem that has continuously plagued curriculum innovators and decision-makers is, as MacDonald and Walker (1976) argued, has nothing to do with creation of ideas but that of impact, "...the failure to achieve anything like the mass conversion to new aims, new content, and new approaches that they aspire to. The schools have not, it seems been transformed by all the organized, systematized, specialized efforts of the professional innovators...." (p.5). The reason for advocating the use of tested models in the present study is because not to do so would amount to groping in the dark, that is, designing, packaging and implementing new ideas that in the end will change nothing. As Harris, et al. (1995) argued, a curriculum innovation model presents information in such a manner as to enhance understanding. A model provides basis for action and specifies curriculum decision-making procedures, delegation of responsibilities and a host of other important areas of management and implementation of the entire process.

Brief Review of Selected Models and Phases

There are a number of models and phases which have been developed and successfully used in creating curriculum reforms in many different countries. The models include, on the one hand, school-based or teacher-centred approach sometimes called the Bottom-Up strategy. This approach has been advocated by a number of recent studies including Skilbeck (1990), OECD (1979), McNeil (1995), Zumwalt (1995), Tanner and Tanner (1980).

On the other hand, Schon's (1971) C-P model and Havelock's (1975) R, D&D model sometimes called the Top-Down or the Bureaucratic approach to curriculum innovation. In this paper, the last two models are described in detail, primarily because of their centralized approach to curriculum reform which, in the view of the present author, is similar to the change strategy currently in use in the Brunei Darussalam education system. cursory remarks are made to the Bottom-Up strategy by way of comparison only.

The Centre-Periphery (C-P) model was developed and popularized by the eminent American educationalist, Donald Schon, and the widely quoted model called the Research, Development and Diffusion (R,D&D) was developed by another highly successful and respected American educationists, Ronald Havelock. Although both of these models had their roots in their developers' country of origin, the U.S., their applicability in other education systems has never been in doubt. There is sufficient literature evidence, for example, MacDonald and Walker, 1976; Morris, 1999; Stenhouse, 1975, which attests to the fact that the models were used in many countries outside USA, though not without criticisms and controversies. The DACUM process is now being used by the DTE-BD to determine contents of new training programmes instead of the conventional need and task analysis methods. In the following section, the merits and weaknesses of the DACUM in

comparison to other approaches will be highlighted and commented upon.

Centre – Periphery (C-P) Model

Donald Schon's design of his three main models of dissemination of innovation was probably one of his greatest contributions to education and society not only in his native America but the rest of the world. These models are: the Centre–Periphery (C–P), the Proliferation of Centres (P-C) and the Periphery–Centre (P–C) sometimes called the Shifting Centres model. It should be emphasized that in designing these main models and their variants (Johnny Appleseed and the Magnet or Travelling Centres), Schon did not see their applications as being limited to education curriculum development. He also saw the models as useful instruments for the transformation of society, as new ideas move from one or more points to permeate and hopefully, change society as a whole. The Proliferation of Centres model is beyond the scope of this study.

Full description of the C–P model is given in Chapter Four of Schon's book titled "Beyond Stable State: Public and Private Learning in a Changing Society" (1971). The C-P model which is the focus of this section of the present paper rests on three important assumptions:

1. The innovation to be implemented exists prior to its diffusion.
2. Diffusion is the movement of an innovation or new idea from a centre out to its ultimate users.
3. Directed diffusion is a centrally managed process of dissemination, training and the provision of resources and incentives.

In the model, new curriculum ideas are conceived, planned, designed, developed and packaged by experts at the centre such as education officers, professional curriculum developers or other central agencies which have close links with the government. The newly developed curriculum is then sent to schools and colleges for wholesale implementation. All through during the process, teachers at the periphery, that is, schools and colleges are often left completely in the dark as to how the decision to innovate came about. The innovators at the centre presume that for as long as the new idea has sufficient appeal to teachers, curriculum adoption would be a bygone conclusion.

Schon argued that the effectiveness of the C–P model depends on a number of factors. These include the level of resources (human, material and financial) at the centre to see the new idea through; energy and enthusiasm of the innovators; number of points at the periphery, the fewer the points the better. Other factors are the length of the spokes or radii through which diffusion takes place; and ways in which information about the innovation moves from the centre to periphery and back to the centre. As will be seen later in this paper, many studies including MacDonald and Walker (1976), OECD (1979), Stenhouse (1975) have criticised the C-P model.

Schon's Periphery–Centre (P–C) or the Shifting Centres model, although not the focus of this paper, it has some relevance in the discussion at hand. This model

is pro schools and teachers. Schon described the model as having the characteristics of contemporary social movements. The P-C is in reverse direction to the C-P model described earlier. In the P-C model, problems are first encountered at the periphery level, and if it appears that innovation is needed, such information is communicated to the central education agency which suggests how solutions to the problems may be found.

The P-C model, according to Schon, is survival prone because it has no clearly established centre which makes it hard to attack. In the model, centres appear, reach a peak, and disappear only to be replaced by new centres. There is also no centrally established message or idea; the message shifts and evolves, producing a family of related messages. This paper partly will discuss the strengths and weaknesses of this model. For the time being, the discussion is now shifted to the second model which, like Schon's C-P model, adopts a centralistic approach to the implementation of curriculum innovation.

Research, Development and Diffusion (R, D&D) Model

Ronald Havelock formulated four models to explain the way knowledge diffuses through social systems. These models are: Research, Development and Diffusion (R, D&D), Social Interaction, Problem Solving, and the Linkage model. This paper will focus on the first model which is of some significance to the present study, where necessary, passing reference will be made to the other three models.

The R, D&D model has some similarities with the C-P model already described. This model is based on the assumption that all new ideas including educational ones necessarily follow an orderly sequence which begins with research, proceeds to development, and then to diffusion of the new idea to the receiver system, that is, teachers in schools and colleges. It is important to mention that the term diffusion in the change continuum is gradually being replaced by dissemination. The reason for this is not very clear. The former, according to MacDonald and Walker (1976), simply means a social process of proliferation of new ideas while the latter indicates "planned pathway" for the transmission of the new ideas from their points of production to locations of potential implementation. The R, D&D model is bureaucratic in that the innovator, usually, an education officer or a consultant acting at the centre, is also the developer of the new idea, and its disseminator as well as the evaluator of its outcomes; leaving the teachers as mere passive receivers and implementers of the new ideas.

Phases of Implementation of Curriculum Innovation

As indicated earlier in this paper, phases or levels of curriculum innovation are not entirely different from models of innovation some of which have already been described. While models describe styles of introducing changes to the curriculum, phases explain activities necessary for the successful implementation of the planned changes.

In the 1950s and early 1960s creating reforms in school curriculum simply

involved redesigning selected topic areas and updating older programmes on a scheduled basis (Wiles and Bondi 1993). This notion changed with the publication of Ralph W. Tyler's classic book titled "Basic Principles of Curriculum and Instruction". The 128 page book set the scene for today's cycles or phases of curriculum innovation. In the book, Tyler posed four fundamental questions concerning school curriculum which modern literature on the subject refer to as the four – step cycle of curriculum reform. These questions are: 1. What educational purposes should the school seek to attain?; 2. How can these experiences be effectively organised?; and 3. How can we determine whether these purposes are being attained? Tyler (1949p.1).

Over the years, Tyler's four-step cycle has been refined by many different authors. For instance, Taba (1962) described the following seven steps:

1. Diagnosis of needs
2. Formulation of objectives
3. Selection of contents
4. Organisation of contents
5. Selection of learning experiences
6. Organisation of learning experiences
7. Determination of what to evaluate and how to do it.

Lynch (1979) described six phases in the process of dissemination of new curriculum ideas. These are based on Havelock's models, and include: i. Building a relationship; ii. Diagnosing the problem; iii. Acquiring relevant resources; iv. Choosing the solution; v. Gaining acceptance; vi. Stabilizing the innovation; and generating social and self renewal.

The Programme Development Section of the DTE-BD is currently using the following five-step programme development cycle modeled on the DACUM process:

1. Analysis
2. Design
3. Development
4. Implementation
5. Evaluation.

Each phase of the DTE-BD programme development cycle will be described in detail shortly but let me first explain the DACUM process so as to avoid any confusion in the minds of the readers. To date, the most prominent advocates of the process are Curtis R. Finch and John R. Crunkilton of the Virginia Polytechnic Institute and State University, USA. The publication of their joint book: "Curriculum Development in Vocational and Technical Education planning, content, and implementation" (see Finch and Crunkilton, 1999) helped to promote the DACUM as a variant or even a replacement of the introspection and the age-long conventional task analysis strategy within a given technical trade area.

Task analysis, is used here to refer to the process whereby tasks performed by technical workers in a given occupation can be identified, properly verified and documented. Finch and Crunkilton (1999) defined DACUM as “a single sheet skill profile that serves as both a curriculum plan and an evaluation instrument for occupational training programmes” (Finch and Crunkilton). The Department of Technical Education in Brunei Darussalam (DTE-BD) version of the strategy is increasingly seen as a ‘reliable’ instrument of selecting what should or should not be included in any technical training course and programme.

Under the DACUM process, the skills profiles in a particular occupation are usually developed by a committee of skilled workers in that area. The profiles are then used to develop instructional content and materials to help students attain the specified skills. According to the authors, the DACUM process has the following advantages: it allows more relevant content to be included in the curriculum; its use of committees means low financial costs; skills profiles are compiled within a short time; and the process enables “curriculum content to be derived with varying degrees of academic intervention” (Frinch and Crunkilton). The DACUM sees little or no role for teachers and trainers in the determination of curriculum content.

“Experiences with this approach have revealed that instructors in an occupational field do not always contribute effectively to the DACUM process. If vocational instructors are involved in the DACUM process, they might be best utilized as ex officio committee members and be brought in after the basic committee has prepared a preliminary or draft profile” (Frinch and Crunkilton).

Phases of the DTE-BD DACUM Process

Analysis: this involves needs and job analysis using DACUM approach, task verification, selection of tasks and standard task analysis.

Design: the design phase involves choosing and recommending a preferred training approach, developing training objectives and recommending training plan to appropriate authorities.

Development: involves the development of training profile chart, and the compilation of training/learning materials to guide and assist both trainers and trainees in their classroom interactions. It also involves pilot- testing the new training plan and making revisions where necessary.

Implementation: the phase involves the dissemination of the new training plan to points of implementation. Teachers and trainers implement the training package and document their views and comments on its usefulness.

Evaluation: the fourth and final phase involves the collection and analysis of information with a view to making judgment about the suitability of the new training plan, its strengths and weaknesses. The information collected becomes useful tool in future decision- making.

Discussion

The discussion in this section concentrates on ways of making centralized model(s) of curriculum innovation more effective in the Brunei Darussalam context. First of all, it is the view of the author that Brunei Darussalam education system is best served by all inclusive and centralized curriculum innovation approach. This position is informed by the following reasons: The country's small population put at 330,700 people according to the 1999 census, and land area of only 5,770 square kilometers as well as good road network make it easy for decision-makers at the centre and teachers in schools and colleges to communicate with one another. Such communication is further enhanced by high literacy rate of 90 percent which is one of the highest in both developed and developing nations of the world as well as availability of modern information technologies. It therefore makes sense to concentrate available expertise, and resources in one location because of the small number of educational establishments located within traveling distance from one another. The Brunei Darussalam Ministry of Education (2000) showed that in the year 2000, the country had 175 primary schools both government and private ones with combined student enrolment of 56,686; 39 secondary schools with enrolment of 31,952; 6 Vocational and Technical Education institutions with enrolment of 2,500 (excluding figures for the ITB). This means that 91,138 students were enrolled in 220 educational establishments below university level. There is no doubt that curriculum decisions and other administrative matters of such a small number of institutions and students can be effectively handled at the central location of the Ministry of Education at Bandar Seri Bagawan.

In taking a centre–periphery stand, the present author is fully aware of the immense powers of the school – based curriculum movements in the U.S. and many European countries including the United Kingdom and how such movements might interpret this posture. However, one should not lose sight of the fact that there are huge differences between USA and Brunei Darussalam and what works in the former may be a complete failure in the latter. The USA has 50 states, a population of 274 million nearly 83 times that of Brunei, and its land area is about 94 million square kilometers, that is, over 16,240 times that of Brunei Darussalam. In Brunei, from one furthest point (Kebi) to another (Bandar Seri Begawan) takes only one and half hours car drive but from California to New York is a solid five hour air flight. Most importantly, in the USA it is the constitutional responsibility of each state to establish and maintain its own educational system. Each state then delegates the control of the system to local communities through local school boards (MacDonald and Walker, 1976). The American scene is dictated by varying complexities of the country, and the social, economic and other differences of the citizenry.

Similarly, in England and Wales, school–based curriculum development has been a long standing tradition. According to OECD (1979), teachers in England and Wales have largely been trusted to determine their own curriculum and methodology in a manner that is appropriate for the children they teach, the community in which they live and available resources.

It should be pointed out that Brunei Darussalam is not alone in the adoption of centre–periphery approach of curriculum reform. In France, the Ministry of

Education is the curriculum authority; changes in school curricula are based on decisions that are taken at national level and circulated to schools for implementation through official channels. Teachers play the role of intermediary between decision makers and students (Skilbeck, 1990). Similar approach exists in Hong Kong where there are legislations for the centralization of curriculum decision-making:

“No person shall use any document for instruction in a class in any school unless particulars of the title, author and publisher of the document and such other particulars of the document as the Director may require have been furnished to the Director not less than fourteen days previously” (Education Regulations, 1971, S92(1) See Morris, 1995p.92).

The debate between proponents of centralized approach to curriculum development and supporters of school-based strategy will go on for a while yet. The outcome will always depend on the circumstances of the country in question and what is considered best and most suitable for its education system.

Conclusion

This study has clearly shown that there are several models and phases of curriculum innovation. Some of the models work well in some countries and not so well in others. Innovators should use their judgment to combine several models so as to derive maximum benefits from the strengths of each model while canceling out its weaknesses.

The present paper has also shown that in the case of Brunei Darussalam the centralized curriculum innovation approach has more advantages than the school-based type. However, for any planned curriculum to succeed, teachers should be actively involved in its planning, design and implementation. Where the initiative to innovate comes from the teacher, the relevant central education agency should offer necessary resources, expertise and professional advice. It is the author's considered view that the best way to ensure meaningful change in any curriculum is to get all the stakeholders of education to work collaboratively.

References

- Ministry of Education of Brunei Darussalam (2000). *Educational Statistics for the Year 2000*. www.moe.gov.bn/statistics/index.htm
- Department of Technical Education (2000). *Programme Development Cycle*. Brunei Darussalam: Department of Technical Education, Unpublished Official Document.
- Finch, C. R. & Crunkilton J. R. (1999). *Curriculum Development in Vocational and Technical Education Planning, Content and Implementation*. Boston, USA: Allyn and Bacon.

- Harris, R. , Guthrie, H., Hobart, B., & Lundberg, D. (1995). *Competency – Based Education and Training*. Australia: Macmillan Education Australia PTY. LTD.
- Havelock, R. G. (1975). *Planning for Innovation Through Dissemination and Utilisation of Knowledge* (5th Edition). Ann Arbor: Centre for Research and Utilisation of Scientific Knowledge.
- MacDonald, B., & Walker, R. (1976). *Changing the Curriculum*. London: Open Books.
- McNeil, L.M. (1995). Local Reform Initiatives and a National Curriculum: Where are the children? In *The Hidden Consequences of a National Curriculum, American Educational Research Association (AERA)* pp.13 – 46. Washington, DC: AERA.
- Morris, P. (1995). *The Hong Kong School Curriculum: Development, Issues and Policies*. Hong Kong: Hong Kong University Press.
- Nisbet, J. (1975). Innovation – bandwagon or hearse? In Harris A., Lawn, M. and Prescott, W. (eds.) *Curriculum Innovation*, pp.1- 14. UK: Croom Helm.
- OECD. (1979). *School – Based Curriculum Development*. Paris: Centre for Educational Research and Innovation.
- Open University. (1976). *Innovations: Problems and Possibilities*. UK: Open University Press: Units 22 and 23.
- Ruddock, J., & Kelly, P. (1976). *Dissemination of Curriculum Development: current trends*. United Kingdom: NFER.
- Schon, D. A. (1971). *Beyond the Stable State: public and private learning in a changing society*. USA: Temple Smith.
- Shipman, M. (1971). *Education and Modernisation*. United Kingdom: Faber and Faber.
- Skilbeck, M. (1990). *Curriculum Reform. An Overview of Trends*. Paris: OECD.
- Stenhouse, L. (1975). *An Introduction to Curriculum Research and Development*. United Kingdom: Heinemann.
- Taba, H. (1962). *Curriculum Development: theory and practice*. New York: Harcourt, Brace, Jovanovich.
- Tanner, D., & Tanner, L. N. (1980). *Curriculum Development Theory into Practice* (2nd Edition). New York, USA: Macmillan Publishing Co., Inc.
- Wiles, J., & Bondi J. (1993). *Curriculum Development a Guide to Practice* (Fourth Edition). New York: Macmillan Publishing Company.
- Zumwalt, K. (1995). What's a National Curriculum Anyway? In *American Education Research Association (AERA), The Hidden Consequences of a National Curriculum*, pp.1 – 12.

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